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HYPOTHYROIDISM

GENTLEMEN: The patient whom I wish to present for discussion this morning is a widow fifty-one years of age, employed as a "presser" in a dry cleaning establishment. She applied for treatment at the Out-Patient Department of the University on November 23, 1927, complaining of fatigue, rapid loss of weight, headache, and, what seemed to concern her more, an area of pigmentation occupying nearly the whole cheek on both sides of the face. She was transferred to the University Hospital for observation with a "working diagnosis" of "possible malignancy" and placed on the service of Dr. Killins.

Previous History.—As a child she had measles, pertussis, pneumonia, and diphtheria, with complete recovery. Up to the age of thirteen she had frequent attacks of tonsillitis; none since then. At fourteen she had a second attack of pneumonia; at the age of thirty and again at thirty-seven she was confined to bed for a period of ten days with what was diagnosed as appendicitis. No subsequent trouble.

Her menses began at thirteen, were regular, not painful, and ceased at forty-one; no discharge since then. Since early childhood she has had headaches every two or three weeks lasting one or two days. The pain was bilateral, located in the temple region, unaccompanied by nausea, vomiting, or visual disturbance; no family history of headache.

For more than twenty years she has taken a dose of Epsom salts every one or two weeks. Her bowel action was regular, but at frequent intervals she noted a lessened amount of urine passed and a "sluggish feeling," both of which were corrected after taking salts.

She was married at thirty-five and one year later bore a healthy child. During the puerperium all of the hair on the left side of her head came out, leaving that side absolutely bald. After a period of eight months it was replaced by a new growth of hair matching in color and texture that on the right side.

In June, 1920 she noted two areas of alopecia about $1\frac{1}{2}$ inches in diameter located in the parieto-occipital region on either side. After a few weeks a white fuzzy growth of hair was noted in these areas, later other areas of alopecia developed followed by a growth of white hair, the unaffected part of the scalp being covered with brown hair. This process of loss of hair and replacement by white hair continued until all of her hair was white except for an area in the occipital region, which retains its original color. No new areas of alopecia have occurred in four years. There is no history of premature grayness or baldness in her antecedents.

Family History.—Her family history is unimportant save for the prevalence of pneumonia. She lost her father, mother, and husband from this disease; her own life was despaired of on two occasions as a result of it, and her only child was critically ill of the same disease at the age of fourteen.

Present Complaint.—About June 1, 1927 the patient noted an undue fatigue, slight vertigo, and occipital headache. These symptoms have been constant and increasing in severity up to her admission to the hospital. About August 1st she began to lose weight rapidly. Her weight August 1st was 120 pounds and November 23d, $87\frac{1}{2}$ pounds. About September 1st her attention was called by acquaintances to brownish spots on either cheek which at that time were about the size of a ten-cent piece. These have since spread to involve the greater part of the cheek.

For two or three months she has noted some dimness of vision in the right eye. Other senses are normal. Her appetite

was fair, slight discomfort at times in epigastric region first noted in June, 1927, bowels regular, no cough, dyspnea, or palpitation. Urinary function was normal. She slept well. For several years she has noted a dryness of the skin and hair. She was very susceptible to cold and, on the other hand, never too warm even on the hottest days. Numbness and tingling in the hands and feet have been noted off and on for the past few months.

Physical Examination.—The patient is below medium stature and decidedly underweight. Her skin is clear and white. Mucous

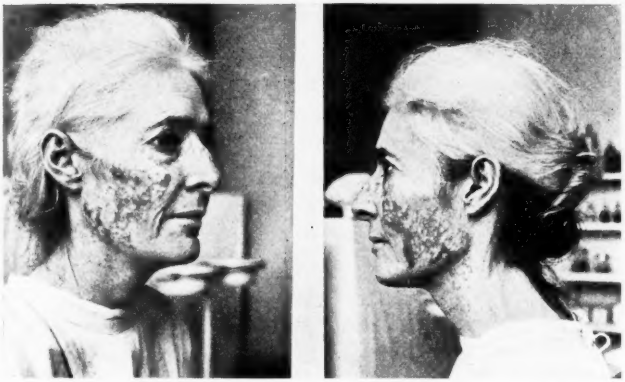

Fig. 55.—Showing pigmentation on face four days after institution of treatment.

membranes pale. The hair is dry and almost snow white, except for an area in the occipital region, where it is brown. The eyebrows are brown with some thinning of the outer third.

On each cheek is an area of brownish pigmentation with an irregular edge occupying most of the side of the face and standing out in marked contrast to the surrounding white skin (Fig. 55).

The pupils react to light and accommodation. Palpebral fissures are widened, nose and accessory sinuses normal. Tonsils small, atrophic, pillars not reddened. Tongue pale, clean. Teeth some fillings. The thyroid gland is not palpable. Ex-

pansion of the chest is symmetric and of good excursion. The heart is not enlarged; the first sound is of muscular quality, but weak; second not accentuated. There are no murmurs. There is no tenderness in the abdomen. The liver, spleen, and kidneys are not palpable. The uterus is small, retroverted, freely movable, and not tender. No edema of the lower extremities. Hands and feet are cold and clammy. All reflexes are present, but sluggish.

Laboratory Findings.—Urine acid, specific gravity 1.014, albumin negative, sugar negative; microscopic negative to casts, blood, or pus cells.

Blood: Hemoglobin 60 per cent., red blood-cells 4,060,000, white blood-cells 5900, polymorphonuclears 55 per cent. No abnormal cells. Wassermann negative. Blood-sugar 87 mg. per 100 c.c. Non-protein nitrogen 32 mg. per 100 c.c.

Gastric analysis: Total acidity, 7 4 7 6 11 8 6
Free HCl, 0 0 0 0 0 0 0

Reaction to adrenalin. Blood-pressure 10.15 A. M. 88/44, pulse 65.

Ten minims adrenalin solution given at 10.25 A. M.

10.35 A. M.: Blood-pressure 120/68, pulse 70.

10.50 A. M.: Blood-pressure 106/22, pulse 78.

11.05 A. M.: Blood-pressure 103/58.

11.20 A. M.: Blood-pressure 92/50.

11.40 A. M.: Blood-pressure 88/50, pulse 76.

Roentgen Examination.—Lungs: Moderate degree of peribronchial thickening, inadequate aëration of left apex. Heart shadow normal. Gastro-intestinal: Stomach moderate cardiospasm, otherwise normal. Duodenal cap normal; colon shows no abnormalities. Teeth: Considerable structural resorption in upper jaw. In the upper jaw there is demonstrated a root fragment just anterior to the remaining molar. There is considerable alveolar resorption about the bicuspid supporting the upper left bridge. The left central incisor is markedly carious. The crowned right bicuspid demonstrated an incomplete filling with some osteitis about the shaft. There is no apparent filling of the root canal. In the lower jaw there was no gross dental

pathology. There is some alveolar resorption with considerable calcareous deposit about the incisors.

Blood-pressure 88/52. Basal metabolic rate minus 19. Pulse 65, temperature 98° F., respirations 18.

Analysis of Important Symptoms.—Premature grayness of the hair is not in this age of "high speed" an unusual finding. In most cases there is a decided hereditary tendency to such; in others the stress and strain of life, especially when entailing prolonged anxiety and worry, apparently acts as an etiologic factor. In such cases isolated gray hairs appear first in the temple region and gradually spread until the whole scalp is covered with gray hair, later becoming white.

In our patient the process was entirely different. There was not a transition from brown to gray and then to white. A local area became denuded of hair, which was replaced in a few weeks with fine hair, which was white on its appearance and retained its whiteness ever afterward. Gradually other areas of alopecia occurred followed by a growth of white hair until the whole head was white save for the area noted in the occipital region. The time of this transition covered a period of three years. The patient has no familial tendency to white hair, neither has she been subjected to any undue fright, anxiety, or worry. The cause in her case evidently lies in a nutritional disturbance.

The pigmentation on the face corresponds to what is variously designated as chloasma, melanoderma, liver spots, and moth patches. From a differential diagnosis standpoint such a pigmentation when considered *per se* is not pathognomonic of any given pathology.

Rehberger, in his Reference Book on Medicine and Surgery, lists over fifty conditions in which pigmentation of the skin occurs. Disturbances in function of the liver and female generative organs are generally considered to be the most common cause of such discoloration, but back of these causes present-day opinion tends to place the primary change in endocrine dysfunction.

The fatigue complained of by the patient was of rather an unusual type. She states that she felt refreshed in the morning after a night's rest and was able to perform her usual duties up

to about 3 o'clock in the afternoon when she experienced a marked sensation of exhaustion and was unable to carry on any farther; after a rest of sixteen to eighteen hours she was again able to work. This was the first symptom noted and has been constant from early June, 1927. The explanation of such a symptom is difficult. We might assume that she possessed marked recuperative powers, but the energy stored up during her hours of rest was not sufficient to carry her through a full day's work.

Bilateral headaches has been noted since early childhood and has continued throughout her life with intermissions of one to three weeks up to a few months ago, when they became less frequent and less severe. With amelioration of these parietal headaches she began to have pain in the occipital region the onset of which was coincident with her complaint of fatigue. Characteristic of this latter pain was the fact that it was uninfluenced by any medication used, but was relieved by prolonged rest.

Loss of weight, which began about August 1st and progressed at the rate of about 10 pounds a month, was not associated with fever, change in diet, diarrhea, or any other known cause.

While under observation for one week in the ward her systolic blood-pressure did not rise above 90. Her pulse at rest ranged from 60 to 65, regular, but weak. Her temperature did not reach normal at any period of the day, averaging from 97° F. in the morning to 97½° F. in the afternoon and evening. Repeated fractional analysis of the gastric content failed to show any free HCl; the highest total acidity being 18. The blood-count showed a moderate anemia of the chlorotic type with a relative increase of lymphocytes. The basal metabolic rate was minus 19 on the first test; repeated minus 17.

Recapitulating the patient's symptoms and findings we have:

Disturbed nutrition of the hair.
Fatigue of high degree.
Pigmentation, localized.
Headache, vertigo.
Loss of weight.

Cold, clammy hands and feet.
Dryness of skin.
Susceptibility to cold.
Paleness of skin and mucous membranes.
Slow pulse.
Low blood-pressure.
Subnormal temperature.
Secondary anemia.
Anacidity.
Early menopause.
Low basal metabolic rate.

Such a group of symptoms occurring in a patient indicate either a disturbance in the physiologic function of an organ or organs having to do with initiating or maintaining so-called vital energy or an excessive demand made upon such mechanism. As causes of the latter may be mentioned any long-continued infection or intoxication; of the former, some disturbance in the glands of internal secretion.

Most of the chronic infections sooner or later produce certain changes in the tissues and body functions by which their nature may be recognized after careful observation. Of the toxemias, those that are associated with focal infections are more easily overlooked. Focal infection manifests itself in a variety of clinical symptoms depending upon the selective or specific affinity of the offending organism for certain tissues, the degree of virulence of the organism, and the resistance of the tissues to infection.

Some cases are characterized by pains in various parts of the body, others by disturbed function of the digestive tract, the circulatory system, or the renal system, and still another group appears to act as a general systemic depressant. This latter group is not uncommonly met with, and probably in the majority of cases is undiagnosed due to failure to discover the focus of infection. The site of infection is not infrequently in the teeth and is of such an insignificant nature as to be overlooked by the dentist and undiscoverable by *x*-ray examination.

This patient presents a fairly good picture of a person harbor-

ing a focus of infection and, in addition, has some questionable teeth and small tonsils which formerly had been the seat of an active infection; both potential factors from an etiologic standpoint.

In attempting a differential diagnosis our patient presents four conspicuous symptoms that cannot be explained on a basis of focal infection, namely, nutritional changes in the hair, pigmentation, low basal metabolic rate, and a different type of fatigue. The fatigue of focal infection is most pronounced upon arising in the morning, continues through the day, and has a tendency to disappear toward night fall. In this patient the reverse is true, well-being is experienced in the morning and exhaustion occurring as night approaches.

If to our patient's group of symptoms were added retardation of the mental processes, slowness of speech, change in voice, increasing thickness of the skin and increase in weight, we would have a typical picture of myxedema of high degree. These cardinal symptoms occur late in the disease and are an indication that the function of the thyroid has been exhausted. Antedating this late stage there must naturally be symptoms indicating impairment in function of the thyroid gland.

The symptoms and signs noted in this patient are those that are associated with the cardinal symptoms in advanced cases of thyroid deficiency. Acting on this hypothesis and in the absence of any other explainable cause the therapeutic test was used as an aid in diagnosis.

The patient was given on November 30, 1927 dried thyroid extract, grain 1, five times daily. On December 4, 1927 the pulse was 72, basal metabolic rate minus 5. There was marked improvement in the patient's general condition, particularly with reference to fatigue. The dose of thyroid extract was then reduced to 2 grains daily. She remained in the hospital one week longer and was then allowed to go home with instructions to continue the medication and report at weekly intervals.

On January 9, 1928 the pulse was 76, blood-pressure 114/72, basal metabolic rate plus 5. Hemoglobin 70 per cent., red blood-cells 4,100,000, white blood-cells 5800. Weight 100 pounds.

Fig. 56.—Showing marked improvement in pigmented areas five weeks after thyroid medication.

Fig. 57.—Showing marked improvement in pigmented areas five weeks after thyroid medication.

There was a marked improvement in her general condition and an almost complete disappearance of the pigmentated areas on her face. No other medication was used except dilute hydro-

chloric acid in 15-minim doses during meals and at fifteen-minute intervals after meals for forty-five minutes. No atten-

Fig. 58.—Showing occipital region of the scalp not involved in the nutritional disturbance.

tion was paid to foci of infection, as we were desirous of watching the effect of thyroid medication.

DISCUSSION

Hypothyroidism, subthyroidism, or **potential myxedema** is a condition apparently becoming more prevalent or, by the aid of modern methods, more easily recognized.

Etiology.—Females are said to be more susceptible than males. All ages are affected, but, according to Higgens, 50 per cent. of the cases occur between the ages of thirty and fifty years. In some cases no cause is determinable, in others colloid goiter, ovariectomy, hysterectomy, foci of infection, hemorrhage in the thyroid, repeated exertion to point of fatigue, protracted

fevers, multiple pregnancies, and obesity are looked upon as being responsible for the exhaustion of thyroid function.

Symptoms.—The symptoms are well illustrated in this case, though they may vary according to the age of the patient in which they are initiated and to the degree of response on the part of the thyroid mechanism. In moderate insufficiency Tice states that both anabolism and catabolism may occur. If one occurs in excess, either gain or loss of weight results. According to Plummer, 13 of 23 cases were underweight. Where the signs of frank myxedema are present gain in weight is the rule.

The hair in young subjects may show no other manifestations than a dryness. In older persons there may be, in addition, thinning of the hair, premature grayness or, according to Engelbach, alopecia areata.

A marked whiteness of the skin is noted especially in those persons who live an indoor life; the mucous membranes are also pale. Analysis of the blood always shows a moderate anemia, the hemoglobin showing a greater reduction proportionately than the red cells. The white cell count is not greatly altered, though there is always a relative lymphocytosis.

Caries of the teeth and pyorrhea are natural consequences of disturbed metabolism and decreased resistance. In women menstrual disturbances, as amenorrhea, dysmenorrhea, metrorrhagia, and early menopause are noted.

The pulse at rest is usually under the normal rate, but during excitement, exercise, or in consequence of an intercurrent infection may be small and rapid.

The blood-pressure is invariably below normal considering 110 as the low normal of systolic pressure for adults. Systolic readings down to 100 or even less are not infrequently found in persons who are apparently in perfect health. Such low pressures may be encountered in several members of certain families. It also occurs in some heavy users of tobacco and in certain cases of focal infection without other symptoms indicating impairment of health.

In hypothyroidism with typical symptoms the systolic rate is usually below 90, the diastolic between 50 and 60. Cases are

not infrequently met with, however, in which all the symptoms of deficient heat production are present with a systolic rate of 100 or even slightly above this figure. Rarely does the systolic pressure reach the low level encountered in Addison's disease.

Nervous symptoms most commonly present are numbness and tingling of the extremities, irritability, diarrhea, and a sense of constriction in the lower occipital region.

A lowered basal metabolic rate is not pathognomonic of hypothyroidism, as some people normally have a lowered rate without any sense of ill-being, but when associated with the symptoms enumerated in this patient it is of the greatest diagnostic importance. Rates of less than −10 should be considered abnormal. In some cases symptoms are manifest with readings of as high as −5.

Diagnosis.—Marked fatigue accompanied by a slow pulse, subnormal temperature, low blood-pressure, cold clammy extremities, and low basal metabolic rate should be looked upon as diagnostic in the absence of any other demonstrable cause. Focal infection, especially of the teeth, and often insignificant as to findings, may produce a clinical picture which closely resembled hypothyroidism. In fact, it may be a part of the picture and stand in an etiologic relationship.

Tuberculosis, profound anemia, Addison's disease, malignancy, gastroptotic dyspepsia, neurocirculatory asthenia, excessive use of tobacco, and abuse of the coal-tar derivatives may be differentiated by a carefully taken history, a thorough physical examination, and intelligent employment of laboratory aids.

Low blood-pressure or a lowered basal metabolism is not diagnostic unless accompanied by such symptoms as are now recognized as being dependent upon a physiologic disturbance of the thyroid.

Treatment.—Diligent search should be made for foci of infection. It is the questionable foci that give us the most trouble.

It takes a man of strong convictions to advise a patient to have teeth extracted which have passed the censorship of com-

petent dentists and roentgenologists, yet the happiest results are sometimes obtained after such procedures. Devitalized teeth and teeth adjacent to formerly abscessed areas should be looked upon with suspicion and removed if no other cause is found.

A maximum amount of rest should be insisted upon. Sun baths for protracted periods are highly beneficial. The diet should be highly nutritious and not accompanied by much liquids at mealtime. Between meals liquids should be given in liberal amounts. If anorexia is complained of, a bitter tonic, as tincture of nucis vomica, 10 minims in 1 dram of tincture gentian compound, may be given fifteen minutes before meals three times daily. In cases of pronounced exhaustion strychnin sulphate hypodermically once daily, beginning with 1/30 grain and increasing gradually up to 1/10 or $\frac{1}{8}$ grain, is frequently of great benefit. If there is distress after eating and anacidity is present, dilute hydrochloric acid in 15-drop doses given in 2 ounces of water during the meal and at fifteen-minute intervals thereafter for three doses will aid digestion and relieve distress. If anacidity is present without symptoms, the acid is not indicated. A daily bowel evacuation is desirable. Irritative cathartics and enemas should not be used. If satisfactory movements are not secured by a suitably arranged diet, recourse may be had to any of the bland oils given at bedtime in 1-ounce doses, and if this is not sufficient, milk of magnesia or cascara may be added to the oil. Should enemas be indicated, plain salt or soda water is preferable to those containing irritants to the mucous membrane.

It is important that these patients have a peaceful night's rest. If rest is disturbed it is far better to give them a soporific than to have them spend what little energy they have in tossing about the bed. Luminal in doses of $1\frac{1}{2}$ grains, medinol in doses of 5 to 10 grains, or any other of the barbitol group may be given at bedtime with a glass of hot water or milk, and continued until the habit of sleeping is produced.

Headache usually responds to rest and stimulation. The occipital type is rebellious to the usual headache remedies, but disappears with general improvement. Parietal pain is often relieved by acid acetyl-sal, 5 grains, acetphenetidin 3 grains,

caffein citrate and camphor monobromid 2 grains, one repeated every four hours.

The main reliance in combating this affection is the administration of the dried extract of the thyroid gland. The initiatory dose should be small, $\frac{1}{2}$ to 1 grain, three times daily after meals and increased cautiously until improvement is noted. The best guide as to when a sufficient dose is reached is the general feeling of the patient. The dose naturally will vary in different patients according to the amount of residual functioning tissue in the thyroid gland.

In increasing the dose careful attention should be paid to the pulse, blood-pressure, and basal metabolic readings. With the approach of any of these readings to the normal the dose should not be increased further, and if signs of restlessness and excitability occur, especially with a rapid pulse, the medicament should be discontinued and resumed cautiously. When a dose is reached which is conducive to a sense of well-being it is best to continue such dose without increase lest more serious consequences ensue from overstimulation.

The basal metabolic rate alone is not a guide to dosage, as some patients experience their maximum well-being at -5, others at zero, and still others at $+5$. Before a quickened pulse is assumed to be due to overdosage other causes should be eliminated, such as an intercurrent infection, excitement, or overexercise. In addition to a rapid pulse excessive dosage may be followed by general nervousness, headache, anorexia, rise in temperature, diarrhea, insomnia, muscle pains, faintness, and dyspnea.

In some patients, even after the judicious use of thyroid extract, no improvement is noted. In such cases the active principle of the gland, thyroxin, may be substituted with benefit. Like thyroid extract, the initial dose should be small (1/300 to 1/150 grain), given two to three times daily and increased gradually until a definite increase in the pulse and the metabolic rate is produced. Thyroxin is said to be more effective when given in a glass of water containing 30 grains of bicarbonate of soda.

When the blood-pressure is especially low suprarenal extract in the dose of 1 to 2 grains may be combined with the thyroid medication.

Whenever a pharmaceutic preparation is heralded as eminently successful in controlling certain clinical syndromes we may soon expect to hear of dire results following its indiscriminate usage. This is due to, first, failure to recognize the condition in which the remedy is indicated; second; improper dosage; third, unfamiliarity with the signs and symptoms initiated by excessive dosage.

The thyroid preparations are potent remedies having definite indications and contraindications in the domain of medicine. Their use is becoming more and more popular, and as a consequence baneful results are not infrequently met with, as may be attested by perusal of current medical literature. Caution is urged, therefore, in the selection of thyroid preparations for the treatment of diseased conditions. Their use is indicated when the main objective is the elevation of tissue metabolism, but even under such circumstances contraindications may exist.

We had in this hospital two years ago a case of myxedema of high degree. She was given thyroid extract in 5-grain doses three times daily for four days and the dose then reduced to 2 grains three times daily. Six days after the initial dose she had a thrombus in the left external jugular, a few days later the right external jugular became thrombosed, later the right brachial followed by a pulmonary thrombus in the right lung; then occlusion of the left radial artery with resulting gangrene of the hand and later amputation. The patient lived three months after the amputation and at the time of her death all the thrombi had been absorbed. Surely thyroid extract was indicated in such a case, but account was not taken of the condition of her myocardium in the selection of the dosage. The patient had marked myocardial changes and the added burden placed upon her defective cardiac musculature by the sudden increase of tissue metabolism was more than the few remaining fibers could respond to. This case should impress upon you the importance of determining the functional ability of the cardiac muscle

before starting thyroid medication. The next important thing for you to do is to thoroughly familiarize yourselves with the signs and symptoms indicative of excessive dosage.

Subsequent History.—For two months previous to the patient's admission to the hospital she was a charge of the Associated Charities of the City of Omaha. On January 28, 1928 (nine and one-half weeks after commencement of thyroid medication) she was able to accept a position and is now self-supporting. The pigmentation has entirely disappeared from her face.

CLINIC OF DR. GEORGE P. PRATT

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GASTROJEJUNOCOLIC FISTULA

DR. PRATT: The 2 cases which I have for presentation today, both postoperative, were selected because they are perhaps the most interesting ones in the wards at this time. They are along different lines of thought; the first a gastrojejunocolic fistula, and the second a case of tetany following thyroidectomy. I have asked Dr. Mohun to give a brief résumé of the history and physical findings of the first case.

DR. MOHUN: Mr. M., aged thirty-six, entered the hospital May 30, 1919, nine years ago, complaining of vomiting and epigastric pain. The vomiting occurred from thirty minutes to one and a half hours after meals. The patient stated the vomitus was fluid and very sour and often consisted of very large amounts of food eaten through the day. The pain, which was located in the region of the epigastrium, came on fifteen to thirty minutes after meals, and was relieved by the vomiting. He gave a history of ulcer pain occurring periodically during the six years previous to admission.

The physical findings were essentially negative except for emaciation, reverse peristaltic waves passing over the stomach, and tenderness in the epigastrium more to the right of the midline.

The laboratory sheet shows a record of one gastric lavage of 3000 c.c. of stomach contents which contained free hydrochloric acid of 29; total acidity of 45. The stools and gastric contents were free from blood. *x*-Ray examination at that time revealed a large dilated atonic stomach reaching to the brim of the pelvis with a 50 per cent. residue after twenty hours.

The diagnosis was pyloric stenosis on a basis of an old ulcer. An operation was performed July 9, 1919, after a short ulcer

management. The surgeon reported a large atonic stomach with a partial obstruction at the pylorus, due to scar tissue. A posterior gastro-enterostomy was performed. There is a note on the progress sheet stating that the patient was up on the seventh day and able to eat any food without discomfort. He was discharged July 23, 1919. It is interesting to know this case was shown in the staff clinic July 12, 1919.

The *present admission* occurred three weeks ago and the patient gave the following history: After the gastro-enterostomy he was well for two years, and then the stomach trouble returned, which he says was the same as before the operation. Pain after eating relieved by food. He consulted his local physician, who put him on a milk diet. This attack cleared up. The gastric pain returned, however, for varying intervals during the next six years. The last attack, which started about six weeks ago, was the most severe of all. The pain was quite severe and occurred regularly after meals. At times the stools were dark and tarry. He then began to vomit after meals and suffered marked constipation and loss of weight. Three weeks ago the vomiting ceased and the constipation was replaced by diarrhea. The diarrhea now became the most prominent symptom, occurring as often as ten to twenty-five times a day. The diarrhea was so severe that he observed a piece of pear which he ate in the stool forty-five minutes later. He became gradually weaker and his weight fell off 35 pounds.

The physical examination is essentially negative except for the marked degree of emaciation and the abdominal scar of the gastro-enterostomy.

Laboratory findings: The urine is negative. The red blood-cell count was 3,500,000; hemoglobin 67 per cent.; white blood-cell count 12,600; differential normal. Stools contain blood, undigested food, and pus cells about 2+. The free HCl ranged from 35 in the fasting specimen to 108 in the sixth specimen after a Rehfuss test meal. The total acid was from 67 to 135. Blood-pressure: Systolic 94, diastolic 52. The Wassermann test was negative.

DR. PRATT: This patient is thirty-six years old and weighs

87 pounds. He came to this hospital eight years ago with a duodenal ulcer complicated by pyloric obstruction for the relief of which a gastro-enterostomy was done. He enjoyed good health for two years and then his stomach distress returned, troubling him at intervals up to the present attack, which started six weeks ago. The gastric pain then became very acute after meals and was associated with vomiting and constipation. Three weeks before admission the pain and vomiting ceased and the constipation was replaced by severe diarrhea. So severe was the diarrhea that a piece of pear went through his gastro-intestinal tract in forty-five minutes. Dr. Mohun told me he has recognized chocolate malted milk in the stools twenty minutes after ingestion.

What has happened here? First, the duodenal ulcer and gastro-enterostomy. Then an ulcer developed, probably at the stoma, and spread around the jejunum. This ulcer, flaring up and quieting down at intervals, finally became plastered to the colon, and perforated through, producing a gastro-enterocolic fistula. This opening came undoubtedly in this last attack when the vomiting ceased and the diarrhea developed, a lienteric diarrhea caused by the direct passage of stomach contents into the colon. The union between the colon and intestine is not always as simple as I have pictured it. Many times there is a fistulous tract leading through an abscess resulting from a slow perforation. The fistulous tract being really the abscess cavity which has discharged itself into the colon. Double perforation has been described.

Several years ago I had a rather similar and interesting experience. My intern called me to see a case having fecal vomiting. A condition which he could not quite understand. In the ward laboratory he showed me a basin of vomitus. It was clearly thin fecal material. Occult blood was present and there were a few milk curds. Before we could examine the patient his bowels moved and the nurse brought the bed-pan into the laboratory, as she was directed to do. It contained material identical with the vomitus, thin watery fecal material with occult blood and a few milk curds. This, of course, indicated a direct

communication between the stomach and the colon, a gastrocolic fistula. An operation revealed a carcinoma of the colon which had become adherent to the stomach and perforated through. This case was published in the Annals of Surgery

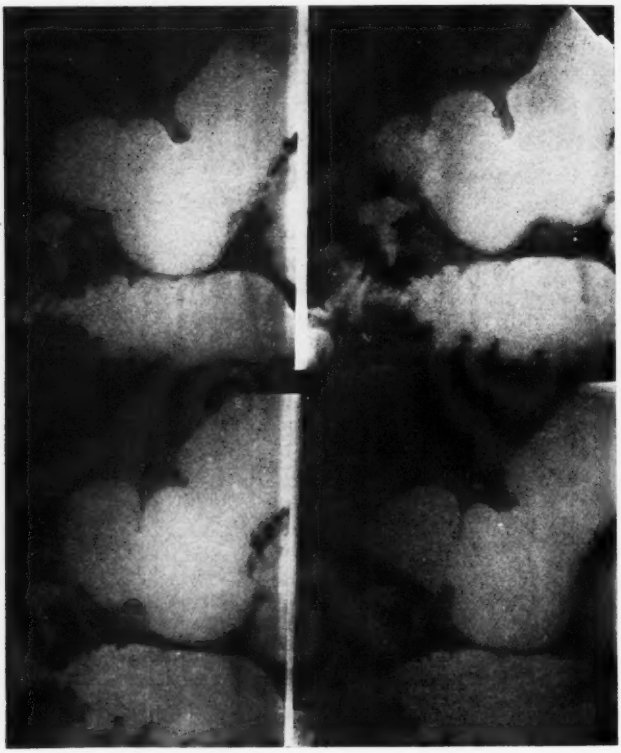

Fig. 59.—Serial study of stomach and proximal colon after gastric meal showing barium passing directly into the colon.

(vol. 77, pp. 433, 1923), and I have here a reprint with photographs of the *x*-ray films and the autopsy specimen showing the interior of the stomach and the stoma opening into the colon which I shall pass around.

Of course the final diagnosis in this kind of a case rests with the *x*-ray findings, and I have asked Dr. Peirce to give us his report.

DR. PEIRCE: The patient was first seen by us on October 27, 1927. The gastro-intestinal series demonstrated the stomach evacuating partially by means of the normal route through the

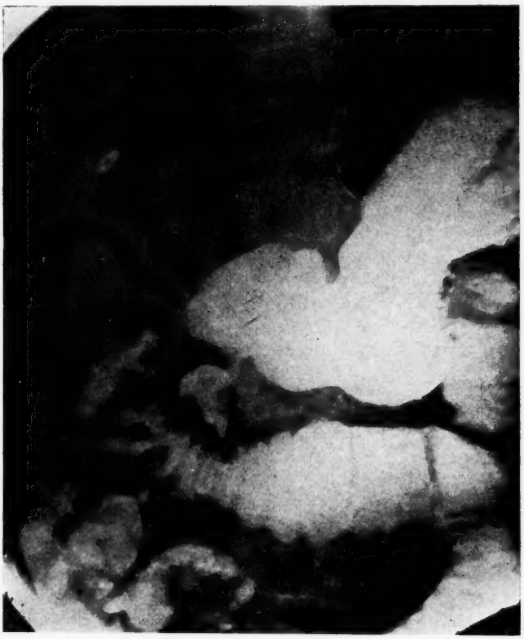

Fig. 60.—Detail of stomach and colon after gastric meal.

duodenum (which was somewhat deformed, the bulb being posterior), and partly through the gastro-enterostomy in the distal portion of the antrum. There was no spasm about the enterostomy stoma. There was noted an area of accumulation of barium, presumably in the small bowel. This, in turn, seemed to be connected with the loops of the jejunum and with a larger portion of the intestine. At that time this was not recognized

as the colon. Upon the introduction of a barium enema the opaque meal was seen to pass normally upward to the proximal portion of the transverse with some increase in haustrations. At that point it passed out of the large bowel and immediately barium was seen scattered through the small bowel. It passed rapidly apparently from this area of retention, which had been

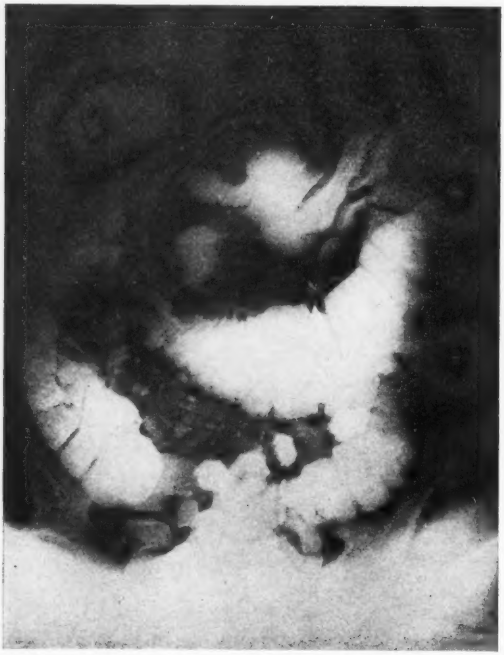

Fig. 61.—Film made after the barium enema showing connection between colon and stomach.

observed previously, into the stomach before the remainder of the transverse colon, ascendans, and cecum were filled. We were not sure that the barium had passed directly into the stomach, so we had the patient evacuate himself as much as possible. A further film study showed the barium-filled colon and the pouch interposed between the colon and the stomach.

The latter was partially filled with some barium passing through the pylorus into the duodenum. We concluded, therefore, that the patient must have a gastrocolic fistula. In order to substantiate our belief we repeated the barium by mouth after an interval of twenty-four hours. This demonstrated conclusively the barium passing from above downward through the old gastro-enterostomy into the jejunum and into the colon in the proximal portion of the transversus. At no time was there any evidence of an active marginal ulcer at the gastro-enterostomy. We concluded, therefore, that although the patient could pass approximately 25 per cent. of his food by means of the normal route through the duodenum, the larger portion of the meal was passing through the old gastro-enterostomy into this fistula, a portion going into the jejunum, but the larger amount of the food passing almost directly into the transverse colon.

DR. PRATT: *x*-Ray examination is not the only positive method of diagnosis. Dye solutions injected into the colon and removed from the stomach through the tube offers a method of absolute diagnosis. I recall a case reported from an army hospital in which it was decided to give a kerosene enema as a therapeutic test in a severe diarrhea. The kerosene injected into the colon was immediately vomited. This, of course, is rather conclusive evidence of a direct communication between the stomach and colon.

A few words about jejunal ulcers following gastro-enterostomy. Their incidence is given at from 2 to 5 per cent. of all cases, these figures being obtained by dividing the total number of all gastro-enterostomies into the number of known jejunal ulcers. This is hardly a fair computation since jejunal ulcers practically always occur in a certain group of cases. They occur in patients having gastro-enterostomies done for duodenal ulcers rather than gastric ulcers. They occur nearly always in men, or about twenty times as often as in women. They are perhaps most apt to occur in cases where there is a high acid stomach content. Now if only those cases of gastro-enterostomy done for duodenal ulcer are considered, one finds the incidence of jejunal ulcer very considerably higher. Using the records of

Mt. Sinai Hospital in New York, Dr. Lewisohn reviewed the subject of jejunal ulcer following gastro-enterostomy. He studied cases having gastro-enterostomies made from 1915 to 1920. It is important to know that during this period gastro-enterostomy was not being done for stomach ulcer—resection being the operation of choice. This then was a consideration only of patients who had a gastro-enterostomy for duodenal ulcer. In this very interesting group he found jejunal ulcer occurring in 34 per cent. of the cases. This higher figure is very probably more nearly correct than the lesser ones usually given. It is certainly a serious drawback to gastro-enterostomy.

You will further recall that the record of postoperative progress presented by Dr. Mohun stated, "The patient was up on the seventh day and able to eat any food without discomfort." That statement must be challenged. I feel surgeons are inclined to advise these patients to eat too freely. This situation brings to mind that at times there is a bit of bad psychology on the part of the medical professoin in regard to ulcer management. It being too generally considered that ulcer treatment is of two distinct types, one medical and one surgical, and that these are diametrically opposed to each other. These two types of treatments, however, should be used together, both aiming for the same thing, namely, the healing of the ulcer. It is my opinion, with which I hope most surgeons will agree, that gastro-enterostomized patients should be put on a special diet to control the gastric acidity and motility. An occasional check of the gastric acidity will give an idea of the degree to which this diet should be restricted, keeping in mind always that a high acid content is not desirable. Furthermore, thorough mastication of all foods should be insisted upon. Large amounts of coarse foods, as pickles, asparagus, celery, and cucumbers, should be excluded from the diet for fear of retention, because they cannot pass the stoma, vomiting and the resulting trauma initiating a jejunal ulcer.

This patient was in a much worse condition a week ago than he is now. We have given him much fluid and glucose and have tried to control his bowels. How do you feel now, Mr. M.?

MR. M.: I feel good.

DR. PRATT: His mental attitude is very good. He is anxious to have the operation, and is to be transferred to the surgical floor this afternoon.

Necropsy Report by Dr. A. J. Miller.—Patient died on the fourth postoperative day.

The body was in a very poor state of nutrition. There was a recent right rectus incision 12 cm. in length, extending downward from the costal margin, in the lower part of which there was a rubber drain. The tissues covering the chest still contained some of the injected fluid. In the region of this fluid there was a small amount of emphysema. These tissues were not infected.

There was about 150 c.c. of cloudy fluid in the pelvis. This fluid contained pus-cells, bacilli, and cocci shown by direct smears. The rubber drain extended to the operative site in the transverse mesocolon. There were fibrinous adhesions attaching the great omentum to the operative field. The right pleural cavity was entirely obliterated by old, dense, fibrous adhesions. On the left side there was 100 c.c. of clear, straw-colored fluid. No changes were noted in the pericardial sac or its fluid.

The heart was atrophic. It weighed 200 gm. No changes were noted in the endocardium. The aorta contained a small number of atheromatous plaques.

The left lung weighed 440 gm. and the right 425 gm. Changes in them were similar. The posterior portion on each side was subcrepitant, dark mottled red in color, and firm. Sectioned surface revealed the irregular, patchy mottling of bronchopneumonia, and bled quite freely.

The esophagus, stomach, and duodenum were opened *in situ*. Just cephalad to the cardia in the posterior wall of the esophagus there was an ulcer 2 cm. in diameter. This ulcer had perforated, allowing gastric content to escape into the periesophageal tissue, forming a mass in the mediastinum just to the left of the esophagus of about 50 c.c. capacity. The upper limit of this mass was at the fifth thoracic vertebra. The base of the ulcer contained practically no granulation tissue. However, in the periphery of the ulcer there was some old, dense,

granulation tissue, indicating that the ulcer was old. There were no ulcerated veins.

The mucosa of the stomach was blotched with recent capillary hemorrhage. The old stoma of the gastro-enterostomy was about 2.5 cm. in diameter. The duodenum just beyond the pylorus was almost obliterated by old scar tissue, forming a diaphragm across the lumen of the duodenum, save for a small opening about 3 mm. in diameter, close to the anterior wall. The gastro-enterostomy stoma had elongated to about 2 cm. The aperture in the transverse mesocolon was made close to the colon. The jejunal wall was eroded on its anterior aspect, close to the stoma, so that it communicated with an ulcer formed in the transverse colon. The short circuit, then, communicated from the stomach to the jejunum, from the jejunum to the transverse colon, and from the stomach to the transverse colon; in other words, there was a three-way fistula. Granulation tissue about it was comparatively dense and there was no evidence of leakage. The opening into the colon was evidently produced by an ulceration on the wall of the jejunum which had gradually worked its way through the mesentery and wall of the bowel. The opening from the ulcer of the colon into the jejunum was closed by recent surgical procedure. The fistula from the stomach into the jejunum and the stomach into the colon, however, remained open. It is difficult to estimate whether or not the formation of the ulcer into the colon was the result of thrombosis of vessels in the mesentery. Some of the smaller vessels were thrombosed, but this is no doubt the result of the ulcerative process and not of the surgical procedure nine years ago.

The liver weighed 1020 gm. It cut with slightly increased resistance and the pattern on the sectioned surface was indistinct. There were no changes in the gall-bladder.

The spleen, pancreas, kidneys, and adrenals were not remarkable save that they were soft and light colored. This was the result of acute degeneration which was present in all viscera of the trunk.

No changes were noted in the bladder or prostate and examinination of the urine revealed nothing abnormal.

Blood drawn from the right atrium, postmortem, remained sterile for seventy-two hours.

The postmortem findings are summarized as healed duodenal ulcer with obstruction; esophageal ulcer with perforation into the mediastinum; old gastro-enterostomy with jejunal ulceration and erosion into the transverse colon, forming a three-way fistula from the stomach into the colon and jejunum; recent surgical closure of the passage from the colon into the jejunum; early peritonitis; early bronchopneumonia, and mediastinitis.

The immediate cause of death is no doubt mediastinitis, resulting from perforation of the esophageal ulcer. This should be thought of as a chemical inflammation rather than infectious. The peritonitis was agonal, since it was not accompanied by any local reaction on the part of the tissues except for a few leukocytes. The pneumonia is also believed to be agonal and only a few hours old. These two conditions, the peritonitis and the pneumonia, are interpreted as complications of the mediastinitis which was the primary fatal condition. The gastro-enterostomy stoma because of the lengthening apparently resulting from traction, and also because of the chronic ulceration in its wall, was not a straight passage, but quite tortuous. This would explain improper functioning of the stoma. The formation of the communication between the stoma and the transverse colon is believed to be the result of a peptic ulcer formed in the jejunum at the stoma which eroded its way through the transverse colon into the wall of the bowel. There is no demonstrable explanation for the recent activity of the esophageal ulcer, causing it to perforate. One could reason that the emesis accompanying anesthesia would be an important factor in extending the esophageal ulcer because of the increased quantity of gastric juices bathing this ulcer as the result of emesis.

TETANY FOLLOWING THYROIDECTOMY

DR. PRATT: The next patient is a parathyroid case. Dr. Mohun will give us a brief résumé of the history of this case.

DR. MOHUN: The patient, Mrs. B., aged thirty-one, was admitted to the University Hospital August 10, 1927, with a diagnosis of exophthalmic goiter. She showed very acute thyroid crises, with auricular fibrillation, associated with cardiac decompensation, and a basal metabolic rate of +74. She was given Lugol's solution and operated August 29th. There was much oozing at the operation. During the afternoon and night there was more hemorrhage, and the following morning a large blood-clot was removed and the wound packed with gauze. On September 1st the wound was closed with suture. The patient made a very nice recovery from this time on. September 13th the basal metabolic rate was +40 and the patient was dismissed September 17th in good condition. The wound was healed and the heart was apparently compensated and doing well.

The present trouble for which she returned to the Hospital October 31st began October 15th. At this time, six weeks after the operation, the patient complained of cramp-like pains first in the hands and then in the feet. There was rather severe epistaxis. Her neck became very sensitive and she showed signs of dyspnea. Her voice at that time was quite hoarse. She was given relief from the attack by her family physician, but a week later there was a recurrence, and the attacks continued with increasing severity.

On admission there was a constant twitching of the face muscles. There was a typical carpopedal spasm. Chvostek's sign was markedly positive. The eyelids were puffy and edematous and the exophthalmus was quite marked. The neck was very tender over the parathyroid glands. There was edema of the ankles and a few moist râles in both bases. The heart was enlarged both to the right and left with a systolic apical murmur and gallop rhythm. The blood-pressure was 130/90.

Laboratory findings: The urine contains 1+ albumin. The red blood-cell count was 4,950,000; hemoglobin 74 per cent.; white blood-cell count 10,800; E. K. G., left preponderance; Wassermann test negative; Blood-sugar 122 mg.; non-protein nitrogen 26 mg.; blood CO_2 combining power, 61 volume per cent.; basal metabolism +33.

DR. PRATT: This patient was operated the last day of August for exophthalmic goiter. She is reported to have had all the typical findings. Before this operation she was decompensated. Following the operation she improved. Six weeks later mild symptoms of tetany developed, for which she was given some relief by her family physician. After a few days the symptoms began again, increased and continued, growing progressively worse up to the present admission, when she first came under my observation. The hand assumed the typical obstetrical position and the legs were in a contracted state with the ankles dorsiflexed, foot slightly inverted, and toes strongly flexed. All the classical signs were demonstrable. The contractures were painful and the patient was suffering very acutely. It was the most marked case of tetany I have ever seen.

Tetany can be produced experimentally by removal of the parathyroids. When the parathyroids are excised the tetany begins immediately. A delayed or latent form of tetany is more common. An appreciable number of patients operated for goiter, 14 per cent., reveal this condition of so-called latent tetany, which is not recognizable until an infection, a menstrual period, a surgical operation, or some other disturbance sets in, which is sufficient to break the compensatory mechanism, and the patient develops typical seizures. In these cases the parathyroids are only partially disabled, probably due to a progressing disability from extending thrombosis, trauma, contracture of scar tissue, or the end-result of a chronic parathyroiditis. This case would have to be considered as a delayed or latent type of tetany.

The exact mechanism of tetany is open to some speculation. There are two main theories as to its causation. One, that secretion of the parathyroids has to do with calcium metabolism.

With hypofunctioning parathyroids the calcium content of the blood is diminished, the ratio of sodium and potassium to calcium thus being raised. The body is now more under the irritant influence of sodium, resulting in tetany. The strongest point in favor of this theory is the low calcium content of the blood in cases of developed tetany. However, the fact that at the outset of tetany the blood calcium is quite normal speaks against it. A second view is the detoxication theory, according to which tetany is due to intoxication, the parathyroids constituting an important part of the detoxicating apparatus.

The toxic substances responsible for the attack come chiefly from the gastro-intestinal tract. They are probably protein split products of the nature of amines formed from proteolytic putrefaction, and affect the body in a manner similar to strychnin. The function of the parathyroids is to prevent intoxication by these poisons. In proof of this theory it is demonstrated that experimental animals, whose parathyroids have been removed, can be carried along symptom free by eliminating proleolytic putrefaction in the colon. A meat-free diet with plenty of milk usually accomplishes this purpose.

With these two theories in mind we outlined a treatment for the relief of the tetany. First, to combat the low calcium content of the blood 15 grains of calcium chlorid were given intravenously, and repeated the next day. At the same time 25 grains of calcium chlorid were given by mouth three times a day. The lactate may be used in place of the chlorid. It is more palatable, but should be used in somewhat larger doses. We augmented this treatment with Collip's parathormone. It is an aqueous extract of beef parathyroid, put up by Lilly, and comes in a 5-c.c. ampule, to be used intramuscularly or intravenously. We chose the former method. This preparation is active and standardized so that 100 units is enough to raise the blood calcium 5 mg. in a dog weighing 20 kilos. We decided in this case to use 1 c.c. every eight hours; 1 c.c. contains 20 units. On November 1st, the day after admission, the blood calcium was 5.4 mg. per 100 c.c. of serum. Normally serum contains 9 to 11 mg. per cent. Ca. The next day it increased to 8 mg. and the

day after to 8.8 mg. As the calcium started going up, all symptoms of tetany disappeared, and the general condition of the patient improved. On November 8th the calcium rose to 11 mg. and we discontinued the parathormone. The blood calcium has to be watched carefully to avoid a condition of hypercalcemia. Short periods of hypercalcemia are not serious, but a long-continued action of too high blood calcium produces a train of symptoms in animals which likewise terminates fatally. The animals become dizzy, go into coma, and die. The condition is associated with anuria and acidosis, and the whole gastrointestinal tract is congested, with bleeding into the lumen. Twelve mg. per 100 c.c. may be considered the upper limit, and no further therapeutic effort should be made to go beyond this. Our problem now is to determine the minimal amount of parathormone necessary for this patient, and we hope that, as usually happens, the organism will ultimately adjust itself so that the antitetany therapy will be unnecessary. In experimental animals which have had their parathyroids removed the calcium metabolism is so adjusted that therapy is no longer needed after they were kept alive from five to six weeks.

Besides this therapy directed toward raising the Ca level we resorted also to dietetic measures. A diet was prescribed aiming to do away with proteolytic putrefaction. The patient was given a meat-free diet containing 1000 c.c. of milk, 200 grams of lactose, and the free use of carbohydrates to bring the total calories to a high figure. Fluids were forced to the limit. I have recently had a thyroidectomized patient who was relieved of paresthesia, pain, and stiffness in the muscles of the legs and hands on the above diet and no other form of therapy. The paresthesia and stiffness are interpreted as signs of a mild latent tetany. Milk cultures of the acidophilus bacillus may be added to the above diet, or used to replace the lactose, if it is not well tolerated. An attempt is made to render the stools aciduric.

This treatment has given very good results and, while the patient still manifests plenty of pathologic physiology, the prompt relief of the tetany is very gratifying.

The pathology of these particular parathyroids is problem

atic. Since the onset of the tetany came six weeks after operation we do not think the parathyroids were excised. This case must be placed in the group of latent tetany. Here there was, if you remember, so much hemorrhage after the operation that it was necessary to open the wound and pack it. This trauma may have been responsible for extensive thrombosis, which gradually increased until the blood-supply of the parathyroids had become involved. Scar tissue contraction and chronic inflammation should, of course, also be considered as possible causes of the injury sustained by the parathyroid glands.

CLINIC OF DRS. A. D. DUNN, INTERNIST, AND
A. J. MILLER, PATHOLOGIST

NEBRASKA UNIVERSITY HOSPITAL

CLINICO-PATHOLOGIC CONFERENCE

Case I.—A white married man of fifty walked into the hospital complaining of:

Epigastric pain radiating over precordial area and relieved by soda.

Weakness, insomnia, and *shortness of breath.*

Dry cough.

Onset and Development.—Two years ago, just before lunch, the patient was seized with a sudden sharp pain in the epigastrium which doubled him up, lasting about five minutes. He had been free from serious illnesses in the past and had had no prior trouble similar to this. He was scared and went to a doctor, who put him on an orange juice diet, but the attacks recurred. Later he was given a milk-and-egg diet and powders, with the omission of all sour foods. He felt well on this diet and was relieved until one and a half years later, except that he noticed some dull pain and quite a bit of burning and belching coming on three-quarters to one and a half hours after eating, which was relieved by soda or by eating. The burning and distress was especially marked at night.

On May 25, 1927 he had a very sharp pain in the epigastrium just before his evening meal. This was slightly relieved by soda, and as the pain became more severe he was taken to the Kansas City General Hospital in an ambulance. The patient gave few definite details of this attack. At the hospital some liquid medicine gave him relief and he was kept there fourteen days on a Sippy diet. He was *x*-rayed and was told that he had an ulcer

of the stomach. He returned to Omaha in four weeks, eight weeks before his entrance on August 17, 1927.

Two weeks before entrance pain in epigastrium, gas, and distress recurred, which the patient attributed to breaking diet. He had considerable heartburn and *complained of inability to get his breath.* For the past week he has been constipated. He has lost 18 pounds since May 25, 1927.

DR. DUNN: What does the history of chief complaints and present illness up to the patient's entrance into the University Hospital suggest as the probable cause of the patient's trouble?

STUDENT: Peptic ulcer.

DR. DUNN: What else might give rise to such a symptom complex?

STUDENT: Cholecystitis or appendicitis might do it.

DR. DUNN: Is there anything else? Gastric symptoms of one kind and another may occur in gastric neuroses, constipation, excessive eating, drinking, and smoking. A food-pain and soda ease, food-ease sequence, although they have recently been much stressed in the literature as almost pathognomonic of peptic ulcer, may be associated with other conditions than ulcer. Only when the hunger pain, food ease, and alkali ease occur with almost clocklike regularity may they be used as evidence in the diagnosis of peptic ulcer. Several symptoms specifically mentioned in the history just read stand out: First, in addition to epigastric pain radiating to the precordial region and relieved by food we have weakness, insomnia, dyspnea, and dry cough. Furthermore, we note that the attack of pain two years prior to entrance was sudden and severe. The second attack, in May, 1927, was also severe and evidently life threatening. "Two weeks before entrance the pain in the epigastrium, gas, and distress recurred" and "he had considerable heartburn and *complained of inability to get his breath.*" These symptoms denote a cardiac factor unless further investigation should absolutely disprove such an assumption.

Previous History.—He had pneumonia in 1907.

Family History.—Father died at sixty-five of heart trouble. Mother died of unknown cause. Three brothers died in the war

and one sister died of rheumatism. There is one sister living and well. His wife is living and well. There are no children.

Physical Examination.—A man of about fifty lay on left side in bed. The hands appeared anemic and were cold to the touch. The pupils reacted to light and accommodation. The tongue was coated; the teeth were poor; and the tonsils scarred, red, and inflamed. There were no palpable glands in the neck and no pulsating vessels. The lungs showed no dulness or unusual fremitus and expansion was normal. There was a fine shower of râles inside the scapula over the left lung. The P. M. I. was in the fifth interspace at the midclavicular line. The heart sounds were faint, but seemed to be normal and regular. There was tenderness over the epigastrium, but no rigidity. The reflexes were normal.

Dr. Dunn: The physical examination, you see, gives us little to go on. The only comment on the heart sounds was that they were faint and seemed to be normal and regular. The shower of fine râles heard in the scapular region over the right lung must be assigned to muscle crepitus as there were no further physical findings elicited to explain them.

I should like to comment on the location of the P. M. I. in the fifth interspace in the midclavicular line. Areas of heart dulness should be measured. An apex-beat should be located by measurement from the midsternal line, which is a constant, and not from the nipple, the midclavicular, or axillary lines, which are not constants, but variable.

Laboratory.—The Wassermann was negative. Urine examinations were negative except for a few red blood-cells on August 21st. Blood counts were as follows:

	8/20/27.	9/2/27.	9/22/27.
Hemoglobin	80	76	72
Erythrocytes	4,960,000	4,560,000	5,040,000
Leukocytes	10,320	11,200	10,200
Polymorphonuclears	68	70	74
Lymphocytes	32	30	26

Two stools on August 26th and September 3d were reported as negative and 1+, respectively, for blood (benzidin test). Later, after the patient was on a meat diet, traces of blood were recorded.

A fractional gastric analysis showed free acid in five out of seven samples, reaching 54 in the sixth sample. The total acid reached 67 in that sample.

Progress.—August 21, 1927: *Several attacks of dyspnea have been observed. The patient has broken out with perspiration and shivering, but has not shown fever above 99° F. The attacks have borne very little relation to time of day or to external conditions.*

The attacks just described were presumably cardiac. One must beware of nervous attacks associated with dyspnea, no matter how compelling the psychic picture may be.

August 23, 1927: Dr. Ralston reported many decayed and infected teeth. He advised *x*-ray and probable removal of all teeth.

Which would have been an ill-advised procedure. The wholesale removal of teeth should be advised only after intensive study of the patient and his disease problem.

August 25, 1927: The patient has been having practically no gastric distress. He has been on a Sippy diet since entrance.

September 2, 1927: The patient had another attack on August 29th. *His extremities became cold with a cold perspiration over the entire body. The pulse was rapid and feeble;* he seemed *dyspneic and there was an expression of anxiety on his face.* He described the attack as a gradually increasing pain until "it feels like the cut of a knife." Usually the attacks have not lasted over half an hour; he has had about twelve since his admission two weeks ago. The impression of a large nervous element in the attacks was noted.

September 6, 1927: *x*-Ray report: "Preliminary fluoroscopic examination revealed an essentially normal chest. Acacia mixture passed readily through the esophagus. The further ingestion of the barium meal revealed a rather hypotonic stomach with delayed peristalsis, which became rather gigantic after a time. At no time was a normal duodenal bulb visualized and the patient was definitely tender over this point. At six hours the stomach was empty. The head of the barium column was in the sigmoid; demonstrated rather marked hypermotility. A barium enema was administered, but could not be fluoroscoped.

So far demonstrated, no gross abnormality is found in the major extent of the large bowel. The appendix was visualized. Our findings would be suggestive of duodenal pathology not obstructive in nature." CARLETON B. PEIRCE, M. D.

DR. DUNN: We have roentgenologic evidence suggestive of duodenal pathology and some findings in the history, such as an indefinite alkali ease and food ease, which support the assumption of a duodenal ulcer. The gastric acidity was in the upper normal brackets. There has been no appreciable amount of occult blood in the stools. If an ulcer were found in the duodenum we would not expect it to be active, but an indolent ulcer of the healed, scarring, deforming type. An ulcer of the duodenum would seem little likely to have produced the extremely critical attacks which brought the patient to the hospital.

September 14, 1927: The patient was seen by a surgeon, who advised operative intervention in view of the fact that the sharp attacks of pain were recurring every two to three days.

September 23, 1927: A laparotomy was performed and a dilated duodenum found. Division of small adhesions and a gastro-enterostomy was done. The duodenum was greatly dilated and impossible to deliver.

September 25, 1927: The temperature just before patient went to operation was 99.2° F. and it had been that high only on the two days previous. Within a few hours after operation it rose to 102° F. plus, with pulse up to 130 and *respirations to 30.* The respirations had increased gradually since the previous day. The patient complained of feeling very badly. He vomited some coffee-brown material and strained considerably. The chest was not examined because attempted examination increased the patient's distress, *i. e.*, vomiting. The abdomen was not tender and there was no rigidity. *The pulse became progressively weaker* and patient died at 10 P. M. of the 25th. He had marked *Cheyne-Stokes respiration* at the end.

The man failed to make a normal recovery from his operative intervention. In the closing hours a Cheyne-Stokes respiration was added to help confirm the assumption of a circulatory problem

Diagnosis.—1. Myocardial damage. The clinical course denoted a heart muscle disorder. No physical findings were elicited to assist in explaining the character of the myocardial damage. An electrocardiogram might have helped materially. The suddenness and character of the attacks would suggest a patchy, coronary artery sclerosis. Myocarditis on an intermittent infectious basis might be responsible. The pathologist will have to give us the nature of the heart lesion.

2. The surgeon has given us a dilated duodenum, cause unknown. Might this not have been a functional disturbance of which the autopsy will show no evidence? The roentgenologist failed to demonstrate it. I am skeptical of dilated duodenums that cannot be demonstrated in *x*-ray plates or under the fluoroscope.

3. A healed ulcer (?) of the duodenum, at least the ulcer will have had no active participation in the illness which brought our patient to the hospital.

4. The postoperative febrile manifestations denote a terminal infectious process, location and nature not determinable from the record.

Dr. Miller's Discussion

On external examination the body was noted to be in a fair state of nutrition. There was no evidence of healing of the surgical incision in the upper abdomen.

The viscera of the abdomen were dry. Viewing the surgical wound from the peritoneal side, it was shown to be gapping slightly and to be covered by a small amount of grayish exudate. Smears of this material contained pus-cells and staphylococci. About 8 c.c. of blood were found in the pelvis. The great omentum was adherent to the sigmoid by dense connective tissue. This did not produce obstruction. The right pleural cavity and the pericardial cavity were obliterated by old adhesions. The parietal pericardium, however, was slightly movable over the heart and there were no adhesions binding the pericardium to the chest wall. The left pleural cavity was without adhesions or excess fluid.

The heart weighed 330 grams. The muscle was very soft and flabby. The outer surface was roughened by tearing away the parietal pericardium. No changes were noted in the valves. The endocardium contained a few small petechiæ.

The aorta contained very little senile arteriosclerosis.

The left lung weighed 380 grams and the right 350 grams. The posterior portions of the upper and lower lobes on each side were dark blood red in color. The sectioned surfaces bled freely. There was only slight crepitus. There was not the usual mottling of a bronchopneumonia. Sections of this tissue showed the air spaces to be filled with fluid exudate and blood. There were no leukocytes. Blood in some of the larger vessels was breaking down. The tissue had begun to disintegrate. The picture was not typical of pneumonia. It is impossible for lung tissue to break down so rapidly without the aid of infection. The process is interpreted, therefore, as a terminal infection ingrafted on lung tissue that was severely damaged by stasis.

The liver weighed 1300 grams. The tissue was soft and light in color with very slight mottling. The bile-ducts were patent; there were no stones or evidences of cystitis. Microscopic study revealed many fat vacuoles in the liver cells. Here and there in the stroma were small collections of leukocytes. These are a common finding in a septicemia. The cells were swollen and granular. There was no passive congestion.

The spleen weighed 120 grams. It was very soft and sections showed the architecture distorted, but there was very little old blood-pigment. There was considerable desquamation and quite a number of polymorphonuclear leukocytes among the pulp cells.

The gastro-intestinal tract revealed nothing of moment on its examination *in situ*. The adhesions mentioned above were producing no obstruction. The duodenum was not dilated. There was the recent gastro-enterostomy which had not resulted in obstruction and was holding perfectly. In the first portion of the duodenum just over the attachment to the pancreas was a stellate scar in the mucosa. This was the result of a duodenal ulcer which was well healed. It produced no obstruction. Sections of this ulcer showed that the mucosa and glands of Brunner

had been included in the ulceration and that the bed was formed by the musculature. It did not extend into the head of the pancreas. The bed was well healed by old scar tissue. Epithelium had grown over it. In the connective tissue between the pancreas and duodenum there was a sparse infiltration of endothelial cells which were laden with blood-pigment.

The pancreas was normal in size. The head portion was spotted with white colored, soft masses, the result of fat necrosis. None of these lesions were found in the tail. There was no hemorrhage about them. The pancreatic ducts were not occluded. These lesions were not confined to the surface, but extended throughout the tissue in the head. Sections revealed that this necrosis was accompanied by no reaction. There were no hemorrhages or leukocytic infiltrations. One or two localized areas in the pancreas contained old scar tissue. There was no demonstrable occlusion of ducts that might account for this fat necrosis.

The kidneys each weighed 140 grams. The capsular surfaces were marked by the pattern of fetal lobulation, but there were no scars. The parenchyma was soft and light in color. Sections revealed cloudy swelling to a marked degree and a small amount of arteriosclerotic damage to the vessels. There were no infarcts.

The adrenals showed nothing unusual except more vacuolation than normal.

Blood taken from the right atrium contained Staphylococcus aureus in pure culture.

DISCUSSION

DR. DUNN: Was the ulcer an old affair?

DR. MILLER: It was old enough to be healed.

DR. DUNN: Was this ulcer likely to have produced crucial symptomatology in the last few weeks of this patient's life?

DR. MILLER: I can't see that it would have been much of a symptom producer.

DR. DUNN: I don't see why you consider the adhesive pericarditis as an unimportant factor in the death of the patient.

Remember how many times the clinician fails to find adhesive pericarditis and diagnoses some heart lesion from a murmur, and the only thing found is adhesive pericarditis. There was much essentially cardiac symptomatology in the clinical course of the case.

DR. MILLER: It seems to me that he should have reacted by cardiac hypertrophy.

DR. DUNN: He had attacks of dyspnea and you haven't anything in the abdomen that explains these particular attacks of pain in the abdomen, cold sweats, pallor, and dyspnea.

DR. MILLER: Perhaps so, but the heart muscle didn't hypertrophy. Perhaps the patient didn't react that way.

DR. DUNN: Was the heart muscle carefully sectioned?

DR. MILLER: As carefully as we do routinely. I have a section of it.

DR. DUNN: A duodenal ulcer could not have produced the picture, and the clinical analysis always leads us back to the heart.

DR. MILLER: There was no evidence of chronic passive congestion in the liver to indicate circulatory failure.

DR. DUNN: The trouble was not an ordinary circulatory failure, but an intermittent affair.

DR. FRANK: The pericardium should be adherent externally should it not?

DR. DUNN: Not necessarily. The presence of adhesive pericarditis suggests at least the possibility of heart muscle damage.

DR. MILLER: Examination of the heart of Case No. 23,478, in light of the clinical impression, revealed interesting pathology. Gross sections of the heart muscle revealed considerable scarring in the left ventricle posteriorly, and also in the lateral group of papillary muscles (Fig. 62). The coronary arteries were opened, but no emboli found. There was a moderate amount of senile arteriosclerosis. Microscopic study of the heart muscle in the region of the scarring showed the muscle to have geen replaced by connective tissue. Evidently these scars were the result of sclerosis occluding small arteries. Some of these could be seen

in the region of the scars (Fig. 63). There was no leukocytic infiltration to indicate that these lesions were active at the time of death.

The necropsy findings may be summarized then as a recent surgical wound in the abdomen infected by Staphylococcus aureus; a staphylococcus septicemia; pneumonia; acute degeneration of kidneys, liver, and spleen; fat necrosis of the head

Fig. 62.—Gross sections of the papillary muscle and the wall of the left ventricle showing the scar tissue resulting from coronary artery sclerosis with occlusion of vessels.

of the pancreas; healed duodenal ulcer; arteriosclerotic scarring of the myocardium; healed pleurisy obliterating the left cavity; healed pericarditis obliterating the cavity, and recent gastroenterostomy.

The patient's exitus is quite clearly attributed to a bloodstream infection which apparently had its origin in the infected surgical wound. The pneumonia is not bronchopneumonia, but

is produced secondary to a blood-stream invasion. The acute degeneration of the viscera is a part of this infectious process.

The pancreatic necrosis is a recent formation. Evidence for this is the lack of scar tissue or other evidences of reaction about

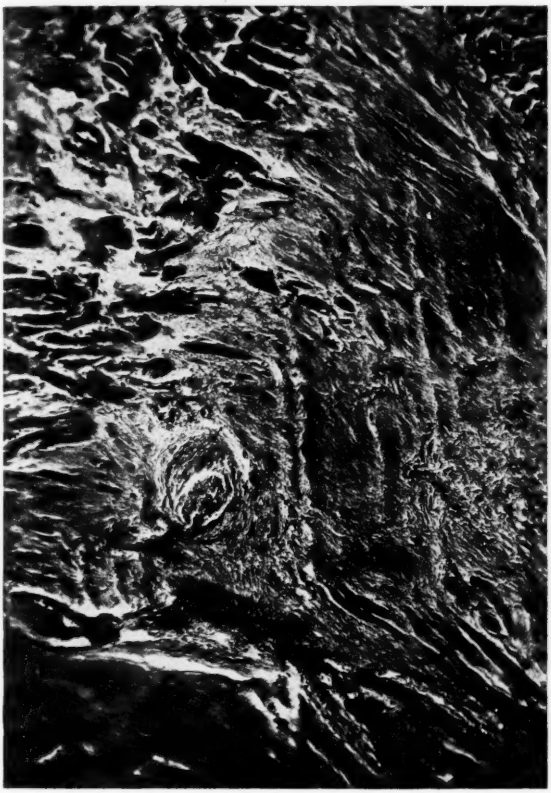

Fig. 63.—Photomicrograph of heart muscle scar. A coronary artery which is almost occluded by senile arteriosclerosis is shown in the periphery of scar.

the necrotic foci. It is not possible, therefore, to explain the pain of which this patient complained on the basis of a pancreatitis. The fat necrosis is not the result of duct occlusion.

There is no continuity of this process with the duodenal ulcer and evidently cannot be secondary to it. The necrosis then is the result of operative trauma and the lack of reaction about it is explained by the poor condition in which the patient was after operation; in other words, there had not been sufficient recovery to allow defensive processes to take place.

The duodenal ulcer is an old one. It is practically healed. There is no gross or microscopic evidence that would indicate the ulcerative process to be extending. The leukocytic infiltration is always present in late healing processes. The scar tissue in the bed of the ulcer is old. There was no obstruction noted on gross examination. It is difficult then to explain the patient's recent symptoms on the basis of ulcer pathology, first, because there was no obstruction, and second, because the ulcer was not active at the time of death. However, it must be remembered that the explanation of pain in peptic ulcer is not clear. We should keep in mind a recent hypothesis which states that the pain of peptic ulcer is the result of neuromata of small nerve trunks embedded in the scar tissue of these ulcers and that pain results from the contraction of scar tissue in them. That situation could exist here. However, the patient's attacks in the hospital do not seem characteristic of peptic ulcer. The earlier ones described in the history seem to be more typical, and possibly those attacks occurred during the time the ulcer was active.

The lesion in the pericardium was old and healed. The scar tissue was not dense enough to bind the pericardium firmly to the musculature. Even after fixation of the tissues the pericardium could be moved over the muscle slightly without much resistance. There was no binding of the pericardial sac to the sternum or ribs; there was no hypertrophy. All of these would indicate that the cardiac embarrassment from pericardial adhesions was nil. It is almost impossible to demonstrate cardiac hypertrophy associated with adhesive pericarditis alone in museum material or in routine autopsy work. In the few instances in which the adhesions appear to have done damage, there are adhesions between the pericardial sac and the chest wall. The scarring in the musculature is quite well localized to

the papillary muscles and the posterior part of the left ventricle. This muscle damage was not extensive enough to result in hypertrophy. The notion is quite well established that these lesions do cause pain, and the record of this patient's more recent attacks fits in quite well with this pathology.

The obliterated left pleural cavity apparently caused no symptoms. The scar tissue here and in the pericardial cavity is similar and it is probable that the pericarditis was secondary to the pleurisy.

DR. DUNN: This confirmation by Dr. Miller of the assumption of myocardial disease that we made from the clinical record supports our faith in the meaning of symptoms. We have heard much of late of abdominal pain in heart disease. A mistaken diagnosis of cholelithiasis is often made. We might group the symptomatology roughly somewhat as follows:

1. Symptoms arising from acute or chronic stasis. Acute congestion of the liver and viscera occur in cases of relatively sudden heart failure. One often reads in the morning paper of a prominent citizen who has died from an attack of acute indigestion. Such patients have pain of a bursting character, marked tenderness in the epigastrium, and often a large and tender liver. If our attention is not too fixed on the epigastrium we may note shortness of breath, rapid irregular heart action, moisture at the base of the lungs, and other findings that will show cardiac responsibility. Cases of stasis are relatively easy to differentiate because the common signs of cardiac failure, such as edema of the extremities, ascites, dyspnea, passive congestion of the liver and heart findings indicative of a badly behaving motor, are present. If the stasis has existed for some time the liver is not tender. Only the relatively acutely congested liver is painful and tender.

2. Abdominal angina-coronary artery thrombosis. In these cases the trouble comes on in attacks, often with exquisite pain requiring hypodermics, often associated with nausea and vomiting. If these cases are analyzed one will always pick up something in connection with the attack that will suggest a cardiac origin. When it came to the time of this man's death we found

Cheyne-Stokes respiration which is of circulatory origin. Electrocardiograms will usually show inverted T waves and often distorted Q. R. S. complexes.

While a blood-stream infection may have been the immediate cause of death, it was terminal, and as such had nothing to do with the diagnostic problem which this case presented, viz., the differentiation of abdominal symptoms of cardiac origin from surgical disease of the upper abdomen.

CLINIC OF DR. WILLIAM N. ANDERSON

UNIVERSITY OF NEBRASKA, COLLEGE OF MEDICINE

PHYSICAL EXAMINATION OF THE HEART

SURROUNDED as we are with instruments expected to disclose with accuracy facts about the heart, we must reflect with admiration upon the ability of our early physicians. Picture if you can the methods of examination which must have been in vogue before Auenbrugger described his methods of percussion in 1761 and its subsequent popularization by Corvisart in 1808. But when in 1816 Laennec presented his stethoscope we can well imagine how physicians the world over journeyed to Paris that they might, through its use, learn the language of the heart.

Yet only a hundred years later Mackenzie is quoted as saying, "The stethoscope not only for one hundred years has hampered the progress of knowledge of heart affections, but it has done more harm than good, in that many people have had the tenor of their lives altered, have been forbidden to undertake duties for which they were perfectly competent, and have been subjected to unnecessary treatment because of its findings."

It must be admitted that very little of value has been added to the sum total of that knowledge since the time of Skoda, 1839, who correlated physical signs with postmortem findings and established the modern science of physical diagnosis. Electrocardiography has brought order out of chaos in the matter of cardiac irregularities, but the greatest value is not in the wonders of the instrument, but rather in the fact that the workers in that field have so thoroughly correlated its findings with clinical observations that it is now possible to recognize most of these conditions at the bedside without its use.

Bearing in mind the principles of diagnosis and the clinical facts which have been bequeathed to us, let us approach the case

and determine upon a method of examination by means of which an estimation of the existence and nature of heart disease can be made at the bedside. What shall we search for? How shall we proceed? What conclusions shall we draw from the facts found?

Our first duty is to determine whether decompensation is present. This is an estimate of the impaired physiology of heart muscle the answer to which is not to be found in the heart itself, but by a general examination of all the organs of the body. A second duty is to make a diagnosis of the pathologic or deranged anatomic state of the heart. While accomplishing both of these, the underlying cause can oftimes be found and should be looked for.

The outlook, therefore, is not only a physiologic one, but an anatomic and etiologic one as well. Should the cardiopathies be classed along the same lines one would find them falling into four chief groups: congenital, luetic, inflammatory, and toxic-degenerative. The first three are explanatory in themselves, the fourth is a large group including the atherosclerotic, nephritic, thyroid, toxic, etc.

This woman, aged forty-five, tells us that four years ago she first noticed a sudden attack of palpitation, of a rapid irregular nature, lasting about twelve hours. During the next three years there were five such spells, between which she felt well. One year ago these attacks became more common, some shortness of breath appeared, she had a vomiting spell, and her strength was such that she was kept in bed for six weeks. Since that time she has avoided overexertion and has kept quite well.

About six weeks ago the shortness of breath became much more noticeable. There developed a tight full feeling through the upper abdomen which later became quite a severe pain under the right costal border. This was made worse with activity. It was not connected in any way with eating. There developed a non-productive nervous cough. The irregularity has been constant since then. She has been wakeful and more short of breath. Three days ago she suffered a stabbing pain in the right chest as if it were deep in the lung about the middle of the chest. Since then she has coughed

more and has expectorated mucus with streaks of blood. She thinks she has had a fever since.

She has never been pregnant. At first the attacks seemed to come near her menses, which have always been regular. She has lost 27 pounds in the last year.

Previous History.—She had a period of seven years, from six to thirteen, in which she had a great deal of illness. First there was a severe attack of scarlet fever, followed by rheumatic fever, in which several joints were enlarged and swollen. With this she was laid up for three months. There was a recurrence of this, and the next year chorea forced her to be out of school for six months. Throughout this period she had frequent attacks of sore throat, none, however, since her thirteenth year. She had a mild attack of "Flu" in 1920.

Although a good history is essential it is important that you proceed without prejudice in obtaining it. The irregularities can ofttimes be diagnosed best and only by the history, inasmuch as the attacks come at times when they are not seen or found by the examiner. An accurate description of these can usually be obtained from the patient without asking leading questions. By the history, also, one gains information as to the etiology of the disease with at least some inkling of the anatomic changes. It must be evident that she has had attacks of paroxysmal irregularity which eventually have become persistent, and we conclude that it must be an auricular fibrillation. Her shortness of breath and abdominal distress together with cough makes us think at once of cardiac decompensation, and without edema being present we are at once suspicious of a mitral stenosis. The pain in the chest with fever will prompt us to look closely over the lungs for complications. Finally in her previous history we find sore throat, polyarthritis, chorea, and we must assume that the etiologic cause is rheumatic fever.

As she answers these questions we have put to her, her voice becomes weaker at the end of the sentence, when she may be seen to pant to get air, and usually gives a few little staccato coughs. Should she talk longer her voice would become hoarse. This condition is very characteristic of auricular fibrillation, and at times results in a true left recurrent laryngeal palsy.

The most striking feature of this patient is the facial color. Notice the deep color of the lips. It is not the color of rouge, but is bluish red. Her cheeks are quite the same, as are the tips of the ears. In the cheeks can be seen also some small venules. Now back of all this color can be seen a tinge of yellow even more noticeable upon the neck and upper chest. Cyanosis is a sign of insufficient aëration in the lungs, and if due to heart disease must be significant of those lesions giving a change in the pulmonary circulation. You see here a type which is very characteristic of mitral stenosis of severe degree. Some form of this is present in the milder grades. When auricular fibrillation is present the picture is even more exaggerated. The plethora of the fat hypersensitive individual should not be confusing to you, as in that condition there is more vessel prominence and less general color. Wide auricular dilatation in tricuspid insufficiency makes more cyanosis, as do the congenital lesions. The latter, of course, date from childhood. The subicteric tint is suggestive of mitral stenosis or adhesive pericarditis, and should direct our examination to the liver when the time comes. When pallor is the prominent feature, particularly if the carotids are visibly pulsating, aortic insufficiency is assured. If anemia is present, so that the appearance is waxy, a subacute bacterial endocarditis is more apt to be present. This is especially so if there is a clubbing of the finger ends or signs of petechiæ present. Anemia may be a part of an acute endocarditis of any type.

She is only comfortable with head elevated. A decompensated heart forces the patient to an upright position save when the right side has given way as well, when severe edema may be present and the patient can still lie flat with comfort.

The hair is oily, not dry. Eyes react to light. No signs of cranial nerve paralysis. She breathes freely through the nose. The alæ dilate with breathing as though dyspneic. There are no enlarged cervical glands. The thyroid is not enlarged. Your attention should always be directed toward endocrine disturbances which may be the basic condition of which the cardiopathy is but the manifestation. Of these, hyperthyroidism with its ocular staring, alertness, tremor, and vasomotor paresis, stands

in contrast to the hypothyroid state of the opposite type with dry hair, lethargy, absence of struma, and slow pulse. Between these is the third type of dysthyroidism usually accompanied by hard nodules in the thyroid. It is this latter that make for heart muscle damage and frequently are the cause of fibrillation or decompensation. Signs of an old luetic infection may be assumed when the pupils are found to be fixed or there is evidence of a single cranial nerve palsy.

The tongue is red and not coated. Teeth well cared for. No apparent pathology in gums. Tonsils small and buried. Anterior pillars appear red. Inasmuch as there is a history of frequent sore throats in girlhood and a rheumatic syndrome following scarlet fever, it is safe to argue that the tonsils are a seat of infection.

Notice the distended veins in the neck. Even the external jugular is prominent. There is no collapse as is usually seen. If you look closely you will notice some very small and rapid undulations. At the same time you can feel the irregular pulsations of the carotid. Its rate is 105 per minute. The diagnosis of auricular fibrillation is now assured. The carotid pulsations are irregularly irregular, while the venous pulse shows many more auricular undulations. The amount of collapse of the veins during diastole is an estimate of the completeness of emptying of the auricle in diastole, and when such does not occur decompensation will be present. Even when the heart is regular the return of compensation can be visualized by this diastolic collapse of veins. Increased mediastinal pressure from tumors, aneurysms, etc., may make the veins distended; however, the irregular undulations are not present except in fibrillation. In tricuspid insufficiency they are distended as well, but in that case there is a definite systolic elevation from regurgitation. The appearance of the veins in auricular flutter are similar in all essentials except that here the undulations are regular and rapid.

Passing next to the extremities, you will notice that the nails are dusky like the lips. They are not clubbed. By obliterating the radial pulse the vessel wall is soft and free from sclerosis. The pressure required for obliteration varies with each pulse beat. It

is very irregular, having lost its basic rhythm altogether. Rate 105. If you should try to picture a graph of this pulse it would be a group of waves varying in height, rate, and contour. An estimation of blood-pressure in such a case must necessarily include both the maximum and minimum systolic pressure. Certainly a mean is all that can be expressed. Remember that heightened pressure is as significant of aortic disease as low pressure is of mitral. The pulse of aortic insufficiency is one with a sharp apex and driving pulse peak, while one with a slow ascent is so significant of aortic stenosis that a physiologic stenosis can only be diagnosed when a pulsus tardus is present. The pulse of mitral disease is not significant except its low volume.

There is a small amount of edema back of the malleoli and along the shin. Knee-jerks are present. Edema is a sign of decompensation and may or may not be extensive. It is by no means common in the upper extremities, and when present is due to pressure by some part of the heart upon the returning veins.

The abdomen is distended and rounded. The flanks do not bulge. It is tympanitic everywhere. There is no fluid. The liver is enlarged three fingerbreadths below the costal border. Its edge is rounded and very tender. The spleen is not palpable An enlargement of the liver may sometimes be seen and is much more accurately outlined by palpation than by percussion. When ascites is also present, its lower edge can be best appreciated by pushing the finger ends into the right upper quadrant, when it can be felt to go away and return much as the fetal head is felt by ballottement. The presence of fluid may be judged by the shape of the abdomen, but best proved by movable dulness. Mitral stenosis is more apt to produce painful swelling of the liver than any other condition. When the amount of ascites present is out of proportion to the edema of the lower extremities, it is more probably a result of adhesive pericarditis. This likewise gives rise to an enlargement of the liver that is hard like a cirrhosis. A liver enlarged by passive congestion shows a round edge but smooth surface, unlike in this respect a cirrhosis or malignancy. If the liver can be found to be pulsating with systole it is due to a tricuspid insufficiency. An enlarged

spleen is present in subacute bacterial endocarditis or malignant endocarditis, and is not enlarged in rheumatic or other forms of cardiopathies.

An examination of the chest should be left until the last, so that more and more detail can be added to the general findings before a specific examination of the heart is made. *The chest is not deformed. It is well developed and of the short and broad type. There is restriction of motion of the right lower chest* (Fig. 64). *Posteriorly there is absence of vocal fremitus up to an inch below the tip of the right scapula and slightly increased above this line. There*

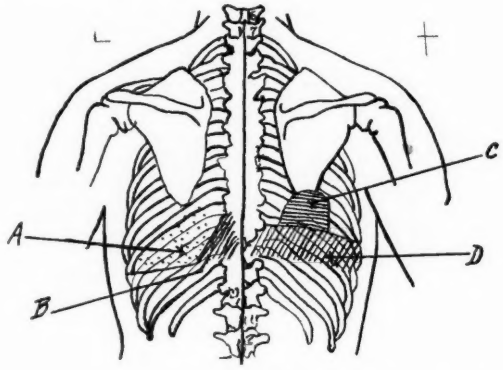

Fig. 64.—*A*, Crepitant râles (congestion). *B*, Dulness (Grocco). *C*, Increased fremitus. Dulness. Bronchial breathing. Bronchophony. Whispered pectoriloquy (embolism). *D*, Absent fremitus. Flatness. Distant bronchial breathing. Distant bronchophony. Distant whispered pectoriloquy. No râles (hydrothorax).

is no change on the left side. Selecting a spot for percussion at the tip of the scapula the right side is dull as compared to the left. Below this on the left the lung is resonant and moves downward into its complimental space 1 inch. Near the spine there is a triangular area of dulness (Grocco). On the right side the dulness at once changes into a flat note with no change in breathing. Now, proceeding upward from these areas, percussing lightly over corresponding areas of the two sides, the left is found resonant throughout. On the right side the dull area extends upward for 2 inches, then

becomes resonant to the apex. By deep percussion the same findings are found on the right, but opposite the fifth and sixth dorsal spines, on the left, there is indistinct dulness. Now, following the same general plan in the examination of the breathing, voice, and whisper, no changes of significance can be found on the left side. On the right, however, over the circular area of dulness there is bronchial breathing, bronchophony, and whispered pectoriloquy. Below this over the flat area these findings are heard, but subdued. There are no râles to be heard over the flat area, but there are numerous soft bubbling râles heard over the dull area. The râles in the base of the left lung are crepitant. Anteriorly there are no changes by percussion or by auscultation. The dome of the liver is in the fourth interspace by deep percussion. The tone changes in percussion as well as the variations in breathing, voice, and whisper, are estimates of the amount of air containing lung as against the part that is solid tissue. It must be, therefore, that there are several different densities and, accordingly, several different conditions or variations of the same. At the extreme bottom of the right lung there is absence of fremitus, flatness by percussion. Opposite to this is a triangular area of dulness, which means a displacement of the mediastinum. There is no skodaic resonance above this level as is usually present, because it is here changed to another type of sound. These are the cardinal signs of fluid in the chest and the diagnosis of hydrothorax is assured. Above this area there is a circular area of dulness through which the auscultatory signs are bronchial in type. It is typically a pneumonic consolidation, but inasmuch as it does not coincide with any lobe, and that it seems to be a solitary circular spot in the lung, one must conclude that it is evidence of a pulmonary embolism. It will be remembered that the patient complained of a pain in the right chest several days ago. The râles in this area are bubbling and expectoration has been quite bloody, bright red, and not dark as pneumonic. At the base of the left lung there is a shower of fine crepitant râles of passive congestion. The area of deep dulness high in the chest is the left auricular dilatation so significant of mitral stenosis and auricular fibrillation.

The apex-beat can be seen (Fig. 65). *It is diffuse, the point of maximum intensity (P. M. I.) being in the fifth interspace 13 cm. outside the midsternal line. There are no more visible pulsations over the precordium. To the left of the lower sternum the percussion note is flat. Now percussing lightly in radial fashion from this spot the superficial area of cardiac dulness can be outlined. This is the reflection of the borders of the lung over the heart. The right lung follows along the middle of the sternum until it reaches the fourth rib, when it deflects sharply to the right beyond the right edge of the sternum to the sixth rib, where it continues to the right. The left lung does not approach the angle of Ludwig by a distance of*

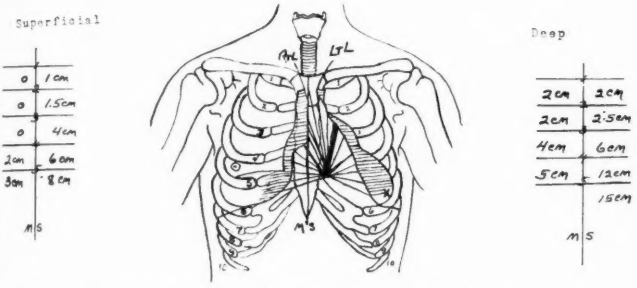

Fig. 65.—Superficial and deep dulness of heart charted, showing how to percuss superficial area from central point radially. On sides measurements.

1½ cm. In the third interspace it is 4 cm. to the left. In the fourth interspace 6 cm. In the fifth, 8 cm. to the left of the midsternal line. It is directed to the left at the sixth rib in the midclavicular line. The P. M. I. is the best criterion to the part of the heart which constitutes the apex. Its location is more accurate than that found by percussion. It is further to the left in this case than is usual with mitral stenosis, and we must look for some other reason for its location. This may be either an enlarged left ventricle as a part of mitral insufficiency, or from adhesive pericarditis. *There is no thrill to be found as is usual, but instead there is an irregularity which can be appreciated. The rate is 110.* The variation here marks a deficit with the pulse, although it is not great. *The sharp systole can be appreciated, although it is*

not marked, and one gets the impression that there is some hypertrophy present. This again must be a part of either insufficiency or pericarditis. The fact that no other movements of the heart can be seen is pretty good evidence that adhesive pericarditis is not present. This can further be ruled out by the superficial area of cardiac dulness, which is not as large as is found in that condition.

The pulmonary vessel is uncovered by the lung. This means that there must be an enlargement of that structure, a circumstance that would not occur unless there was considerable increased pulmonary pressure. This state of affairs is common in mitral stenosis, and at times is severe enough to produce an atheroma of the pulmonary artery even into its smaller branches. There is in these instances a polycythemia present.

In the third interspace the left auricle is so much enlarged that the lung is pushed widely to the side. Inasmuch as this is such an easy place of percussion it is particularly important to study the changes in the left auricle for the presence of mitral stenosis. This area furthermore tells that tricuspid insufficiency is not present, for in such an event the right lung would be deflected to the right in the second and third interspaces. *Here, however, there is a steplike deflection of the lower right border* (*Kroenig's step*) significant of right ventricular hypertrophy. This going hand in hand with the enlarged pulmonary vessel and dilatation of the left auricle completes the picture of mitral stenosis by percussion. Should tricuspid insufficiency be present it would be easy to explain the pulmonary embolism as due to the dislodgment of a vegetation. This is common in subacute bacterial endocarditis, but unusual in rheumatic carditis. Here, then, there must have been a dislodgment of a formed thrombus from the auricle, a circumstance not at all uncommon in fibrillation.

By deep percussion the right border is 5 cm. to the right of the midsternal line. There is no dulness on either side of the sternum in the first interspace. There is dulness just to the left edge of the sternum in the second interspace and 6 cm. to the left in the third interspace. In the fifth interspace the dulness extends 15 cm. to the left of the midsternal line further, as you see, than the apex.

Deep percussion of the heart has its limitations. Unless the right auricle extends definitely to the right of the sternal edge it cannot be found. The dulness at the left border is less accurate than the apex-beat itself. However, dulness at either side of the manubrium should be looked for at all times as indicative of aortic increase. Of the greatest importance is the dulness in the third interspace to the left. This is the area of the left auricle and by its behavior the mitral configuration occurs when it is wide, so that the left border appears like a straight line, or an aortic configuration occurs when the aorta is wide, but this area close to the sternum producing, thereby, a concavity in the left border. The findings here are of a mitral configuration even more marked than usual because the pulmonic vessel as well as the auricle is enlarged. This substantiates the findings and conclusion reached by superficial percussion.

But, I hear you say why should one go through all of this detail of examination when he can listen and tell it all. Herein lies the justification of the criticism of Mackenzie. By experience one learns that auscultation alone will lead him more often astray than will the detailed examination without auscultation. This is so because the ordinary methods of listening for murmurs is based upon a false impression of the importance of these extraneous sounds.

If comparative percussion is valuable, then it must be granted that comparative auscultation is equally important. This can be accomplished by searching for the sounds as made by the right heart and contrasting them with the same sounds as made by the left heart. Now nearly all the pathologic states of the heart are on the left side; as a consequence one has a normal to compare with a pathologic.

One's next effort should be a study of diastole. This for the reason that the extraneous diastolic sounds are always pathologic and important, and if not studied first are often missed by the more prominent and less important systolic ones. *Right first sound rather sharp and with the irregularity varies with different systoles. It is easy now to find the irregularity, rate 115. Passing across to the left there is a place where the first sound changes and*

becomes very sharp, staccato-like, and accented. The pulmonic second sound is very much accented over the aortic. Following downward from the aortic area, to the apex, a short middiastolic murmur can be heard just to the right of the apex. A systolic murmur is heard at the apex with the strong systoles, not with the weak ones. There is a first sound on the left that is very typical of mitral stenosis. There is no presystolic murmur, this being absent in the presence of auricular fibrillation. There is, however, a middiastolic murmur which is due to the aspiratory action of the ventricle and not a part of activity of the auricle. The systolic murmur at the apex tells us that there is an insufficiency also present. This then accounts for the apex being wider than might be expected in a case with more stenosis and less insufficiency.

From an etiologic standpoint rheumatic fever must be the main consideration. This is no doubt due to a tonsillar infection. Decompensation is present as evidenced by auricular fibrillation, a sign of auricular failure; passive congestion of the lung; passive congestion of the liver; edema of feet.

Anatomic diagnosis: Inflammatory cardiopathy (rheumatic). Chronic deforming endocarditis (mitral). Mitral stenosis with insufficiency. Auricular fibrillation. Pulmonary embolism from auricular clot. Hydrothorax. Passive congestion of lungs and liver. Chronic tonsillitis.

Conclusions:

1. Have in mind a classification of cardiopathies that will direct your examination to an end.

2. The presence of decompensation is the first aim. This is not found by an examination of the heart itself by the stethoscope, but by a careful examination of the entire body.

3. The more that can be ascertained about the case before auscultation is started, the more accurate is the diagnosis.

4. To accomplish this end a routine of examination is required, which begins with inspection and ends with auscultation, and which begins away from the heart and ends at the heart.

5. The superficial area of cardiac dulness is the easiest of

determination. Its shape varies with changes in size of the various chambers.

6. Deep percussion has certain errors the importance of which must ever be borne in mind.

7. Auscultation should be comparative, the right side against the left.

(*a*) Rhythm should be first studied.

(*b*) The appreciation of the sounds and their differentiation is of next importance.

(*c*) The diastole should be studied carefully before systole, because extraneous sounds in this cycle are always important and can be easily missed or confused with those of systole.

(*d*) Systolic extraneous sounds should be the last studied and may have no diagnostic significance.

8. Many anatomic lesions of the heart give rise to characteristic forms of decompensation, the appreciation of which adds to the accuracy of the diagnosis.

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GLYCOSURIA, THYROID DISEASE, AND DIABETES

THE causative relationship of various endocrine glands to glycosuria and diabetes has been for years a very interesting field for speculation. Particularly is this true regarding the relationship of the thyroid to carbohydrate metabolism. Many years ago von Noorden[1] described what he called thyroid diabetes and contended that the thyroid and pancreas have antagonistic actions, the former inhibiting the excitability of the latter, and that the more powerful the action of the thyroid the more marked the inhibition. He showed that glycosuria could be induced both in man and animals by the feeding of thyroid, the time of its appearance being merely a question of the amount given. He also showed that it was almost impossible to cause glycosuria in animals after extirpation of the thyroid and contended that the functional activity of the pancreas was increased by the absence of this thyroid influence.

Glycosuria occurs in about 6 per cent. of all cases of hyperthyroidism. Chvostek found sugar in the urine in 69 per cent. and Goldsmith in 19 per cent. of their exophthalmic goiter cases.[2] It is found more commonly in the acute cases.

This morning we want to present 2 cases of adenoma with hyperthyroidism and glycosuria, 2 cases of exophthalmic goiter and glycosuria, 1 case of exophthalmic goiter with diabetes and diabetic gangrene, and discuss the diagnosis and treatment.

Case I.—George S., aged thirty, farmer. Entered the hospital on June 20, 1927, complaining of weakness which he states developed five months ago. Headache for the past five months; increased appetite for the past month; polyuria for the past

month; loss of weight (present weight 129, average weight 135); nervousness; tremor and tachycardia on exertion for the last four years.

Previous History.—Measles and mumps as a child.

Family History.—Father, mother, nine brothers, and three sisters, living and well. He has three children living and well. No history of diabetes, goiter, tuberculosis, nervous or mental disease in the family.

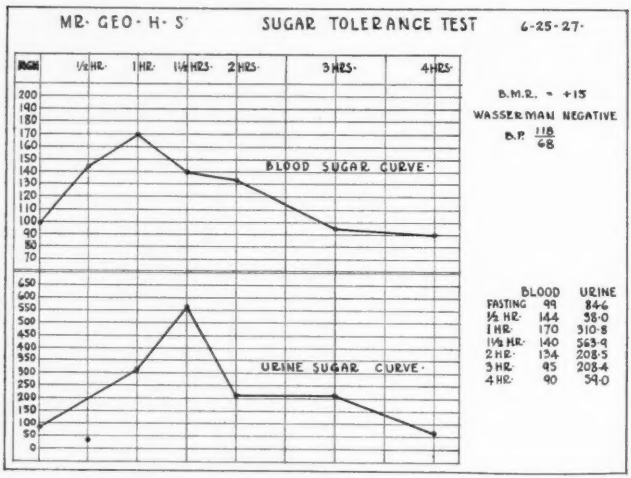

Fig. 66.

Physical Examination.—I shall give only positive findings. The eyes show slight widening of the palpebral margin. Anterior pillars of the fauces slightly injected; golf-ball adenoma, right lower pole of the thyroid. Heart rate 110, apex beat normal, no murmurs. Blood-pressure 116/68. Slight tremor of the hands.

Blood Examination.—Hemoglobin 85 per cent.; red blood-cells 5,280,000; white blood-cells 5300; polymorphonuclear cells 55 per cent.; lymphocytes 45 per cent. Wassermann negative. Urine examination showed a faint trace of sugar. Basal metabolic rate plus 15 per cent.

Comment.—Our first impression of this case was that we were dealing with adenoma with hyperthyroidism but the finding of a trace of sugar in the urine suggested the necessity for a sugar-tolerance test (Fig. 66). The blood-sugar curve in this case returned to 134 in two hours, which would be considered a normal curve. The urinary sugar, however, by the Folin-Bertrand method is, according to Lewis,[3] evidence of a moderately severe disturbance of carbohydrate metabolism. We advised operation but could not obtain the patient's consent. He was, however, operated upon two weeks later in another hospital, and at the present time (January 15, 1928) is entirely sugar free, has gained markedly in weight, has been sugar free throughout the period on a regular diet, which would seem to indicate that the patient was not a diabetic.

Case II.—C. M., aged forty-three, entered the hospital September 21, 1926, complaining of nervousness, restlessness for the past two years, increased appetite with particular craving for carbohydrates, loss of weight, his present weight being 152 and his normal weight 165 pounds.

Previous History.—Lobar pneumonia in 1903, influenzal pneumonia in 1918.

Family History.—Father, mother, one brother, living and well. No history of tuberculosis, cancer, diabetes, or thyroid disease in the family.

Physical Examination.—Tonsils slightly injected. The thyroid shows a golf-ball adenoma, lower portion of the right lobe. Lungs normal; abdomen negative. Heart normal except rate of 100. Wassermann negative. Blood-sugar 112 mg.; hemoglobin 85 per cent.; red blood-cells 4,250,000; white blood-cells 8000; blood-pressure 128/70; basal metabolic rate September 27, 1926 plus 18.

Diagnosis.—Adenoma with hyperthyroidism. Operation, October 1, 1926. The day following the operation a trace of sugar was found in the urine, although all previous urine examinations had been negative. Sugar-tolerance test (Fig. 67) shows a normal blood-sugar curve. This patient since the operation has gained

22 pounds in weight, the heart has returned to a normal rate, and at no time has sugar appeared in the urine on regular diet.

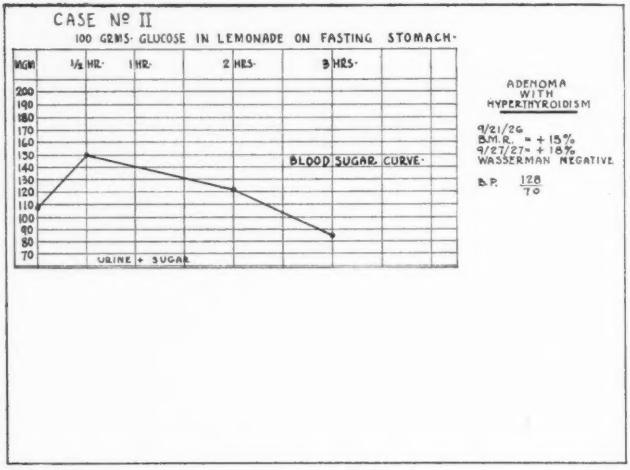

Fig. 67.

Case III.—Mrs. D. A. S., aged twenty-seven, housewife, married, white. Complaining of nervousness, palpitation, loss of weight, dyspnea, weakness, hot flashes plus profuse perspiration, failing vision, enlargement of thyroid with feeling of pressure in the neck. Duration, two years. Loss in weight began six months ago, dropping from 195 to 121 pounds.

Previous History.—Measles, mumps, pertussis, frequent attacks of tonsillitis.

Family History.—Father living and well; mother, aged fifty-two, has goiter. Three brothers living and well; two died at birth. Two sisters died at birth. Four children, living and well.

Physical Examination.—Head negative. Eyes equal, react to light and accommodation. Moderate exophthalmos, some lagging. No ptosis, strabismus, or nystagmus. Nose negative. Tonsils 3 plus. Thyroid enlarged bilaterally. Bruit and thrill heard easily. Lungs negative. Heart rapid; pulse 120, loud, harsh systolic murmur at apex referred to vessels at neck.

Apex beat 9 cm. to left of midsternal line. Pelvic examination showed scar on cervix, retroflected uterus. Tremor of extremities marked. Reflexes normal. Urinary examination: Sp. gr. 1.020, trace of sugar, no albumin, microscopic examination negative. Blood examination: Hemoglobin 80 per cent. Red cells 4,620,000; whites 11,250; polymorphonuclears 62 per cent.; lymphocytes 38 per cent. Wassermann negative. Blood-pressure 120/80. For glucose-tolerance test see Fig. 68.

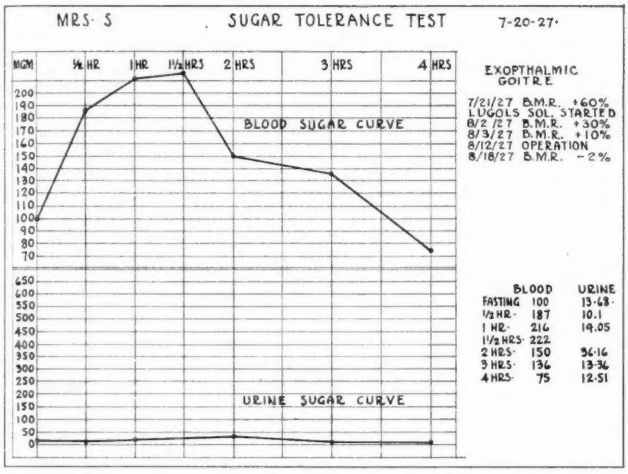

Fig. 68.

Treatment.—This patient was given Lugol's solution. Basal metabolic rate on July 16, 1927 was plus 60; dropped to plus 30 on August 28, 1927. This case was considered one of exophthalmic goiter with functional glycosuria. Operation on August 12, 1927. Metabolic rate (August 18, 1927) minus 2 per cent. Following the operation the glycosuria entirely disappeared.

Case IV.—Gladys T., age seventeen years. Entered the hospital August 15, 1927, complaining of nervousness, headache, shortness of breath, rapid heart action, hot flashes, associated with

profuse perspiration, tremor of the hands and enlargement of thyroid gland, with a feeling of pressure and a choking sensation. Most of these symptoms have developed in the last six months.

Previous History.—Measles, mumps, chickenpox, pertussis, influenza, and tonsillitis.

Family History.—Father, mother, two brothers, and one sister living and well. No history of tuberculosis, diabetes, cancer, or thyroid disease in the family.

Physical Examination.—No marked weight loss, marked tremor of the face and hands, skin moist and hot, patient very

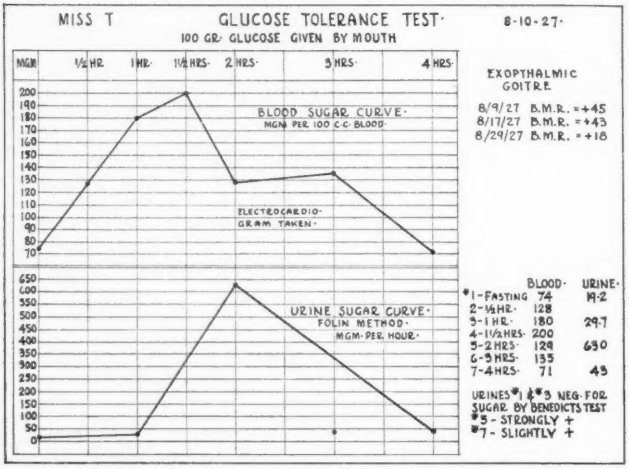

Fig. 69.

nervous, cannot lie quietly. The eyes showed a moderate degree of exophthalmos. Thyroid bilaterally enlarged, soft, and smooth. Systolic bruit easily heard over both lobes; lungs negative; heart apex beat 9 cm. to the left of midsternal line, soft systolic murmur heard best at the apex and transmitted toward the base. Heart-sounds are intense and are heard easily over almost the entire chest. Abdomen negative.

Extremities—reflexes normal, tremor of the hands marked. Blood-pressure 128/64, Wassermann negative. Blood count:

Hemoglobin 70 per cent., red cells 4,210,000, white cells 4040, polymorphonuclear leukocytes 42 per cent., lymphocytes 58 per cent.

Daily urinary examinations from August 5 to 8, 1927 were negative except for slight trace of sugar found on August 12th. Basal metabolic rate August 9th was plus 45. The sugar tolerance test shows the blood-sugar returned to normal at the end of two hours, although the urinary sugar was above the figures given as normal by Lewis. The case was considered one of exophthalmic goiter with glycosuria, and operation advised. The patient was operated upon August 29, 1927, and died suddenly at 3.30 A. M. August 30, 1927 of an acute laryngeal edema.

Discussion.—Giving 100 gm. of glucose on a fasting stomach to normal individuals will cause the blood-sugar to rise to 150 mg. or thereabouts with a rapid fall, oftentimes, to below the starting-point by the end of the second or third hour, and then to gradually rise again. A higher peak and slower drop is found in most hyperthyroid cases. Geyelin[4] has found some degree of hyperglycemia in 90 per cent. of his cases of moderate or severe hyperthyroidism, and has found glycosuria spontaneously or after 100 gm. of glucose very common. Lewis, Rowe and Rogers plotted the curve of urinary sugar in milligrams per hour, and considered the normal as one passing 10–9–10–16–18–15 mg. each hour after the tolerance test. Three of these cases would be considered as cases of disturbed carbohydrate metabolism, if we were to follow their classification.

Dubois[5] found an abnormally high blood-sugar curve for two hours after the ingestion of 100 gm. of glucose in hyperthyroid cases. Sanger and Hun[6] studied 10 normal cases and 10 cases of hyperthyroidism under identical conditions, and showed that the cases of hyperthyroidism are characterized by a rapid rise in blood-sugar and a high peak maintained over a longer period of time. The respiratory quotient, however, that is the relationship between the volume of carbon dioxid given off and the volume of oxygen consumed, rose in the hyperthyroid cases to between 0.9 and 1, distinctly higher than the normal controls. In other words, the higher respiratory

quotient in the hyperthyroid cases shows that there is no diminution in the ability to oxidize carbohydrates or convert them into fat as in the case of the true diabetic, but on the contrary there is an increased carbohydrate utilization in these cases. They believe that the sharp rise in blood-sugar and the elevation of the respiratory quotient are due to the inability of the hyperthyroid cases to store glycogen in the liver, and this disability of the liver to care for the excess of glucose circulating in the blood accounts for a spill-over, when this rises above the normal renal threshold. Clinically the glycosuria found in cases of hyperthyroid disease is small in amount, will appear irregularly, and there will be no parallelism between the glucose intake and the glucose output as is the case in true diabetes. Glucose may be present in the urine even during dietetic restriction.

Von Noorden contends that the thyroid inhibits the excitability of the pancreas. Wilder,[7] however, has shown by injecting glucose at uniform rates that normal individuals may handle 0.8 gm. per kilograms of body weight per hour without glycosuria, while hyperthyroid cases may excrete sugar at injection rates of 0.6 or even 0.5 gm. per kilogram of body weight per hour, and concludes that in hyperthyroidism the rate at which the patient may assimilate glucose may be disturbed, not that there is any fault in its oxidation or reduction.

Janney and Isaacson have found that hyperglycemia was uniformly present in thyroidectomized dogs. It has long been known that thyroid extract fed to normal individuals may provoke an alimentary type of glycosuria and that it, when fed to diabetic patients, causes a marked increase in their glycosuria.

In the true diabetic the fundamental defect is an inability to utilize carbohydrates, and this defect accounts for both hyperglycemia and glycosuria as the diabetes progresses. Benedict and Joslin[2] have shown that the respiratory quotient may go as low as 0.7 per cent., proving this lack of utilization. The opposite is true in hyperthyroidism. By the administration of insulin to a diabetic, this respiratory quotient rises as his power to utilize carbohydrate is restored. Lawrence has shown that the difference in sugar concentration in the arterial and venous blood

is much less in severe diabetics than in the normal, and that, after the diabetes is controlled by the use of insulin, this difference becomes greater, showing an increase in their powers of utilization.

Fitz[8] found 9 cases of true diabetes in 1800 cases of exophthalmic goiter, Wilder[9] found 15 cases in 2340 cases of exophthalmic goiter (or 0.6 per cent.) and 22 cases of diabetes in 1131 cases of adenoma with hyperthyroidism or 2 per cent. Billings found 1 case of diabetes in 61 cases of exophthalmic goiter; Greeley, 6 cases of diabetes in 614 cases of hyperthyroidism; the Massachusetts General Hospital reported 4 cases of diabetes in 415 cases of hyperthyroidism, and Dr. Ralph Thompson, in going over records of the University Hospital, has found 3 cases in which a diagnosis of diabetes was made among 62 cases of hyperthyroidism, or a total of 60 cases in 6323 cases of hyperthyroidism, or 0.9 per cent. These figures are to my mind too small to suggest that hyperthyroidism is a very definite etiological factor in the development of a true diabetes. Diabetes occurs more frequently with adenomatous goiter with hyperthyroidism than with exophthalmic goiter, and this is as should be expected for this type of hyperthyroidism and diabetes both occur in older individuals while exophthalmic goiter occurs more frequently in the younger.

Hyperthyroidism occurring in a diabetic patient is a serious complication, for it increases his metabolic rate and early exhausts his carbohydrate store. With this exhaustion of glycogen there is an imperfect oxidation of fat to carbon dioxid and water, and the patient is particularly prone to develop a diabetic coma. In any diabetic patient, therefore, not responding properly to dietetic and insulin treatment, or any diabetic in coma, hyperthyroidism should be considered a factor, and treatment should be directed toward it. The administration of iodin to the exophthalmic goiter cases slows their metabolism and increases their ability to utilize glucose, as manifested by diminution in the glycosuria and increase in the efficiency of the insulin unit. Case V, Fig. 70 is quite suggestive of this phenonenon.

Case V.—Mrs. J. K., aged sixty-five, Swedish, entered the hospital October 21, 1927 complaining of frequent urination during the last six months, loss of weight (16 pounds), numbness and tingling of the feet, which began two months ago, nervousness, and tachycardia.

Physical Examination.—Head negative. Eyes, moderate degree of exophthalmos. Neck, bilateral enlargement of thyroid gland. Heart and lungs negative. Gangrene of third toe of left foot extending up on the dorsal surface of the foot, with some

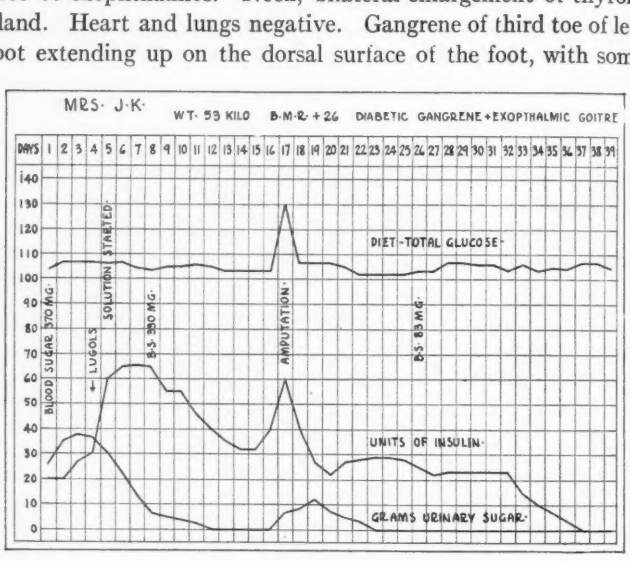

Fig. 70.

discoloration extending up over the anterior portion of the ankle. Dorsalis pedis artery not pulsating.

Blood-pressure 135/80. Blood-count: Red cells 3,700,000, white count 12,000, hemoglobin 78 per cent., polymorphonuclear leukocytes 76 per cent., small lymphocytes 16 per cent., large lymphocytes 6 per cent. Wassermann negative. Blood-sugar 370 mg. Basal metabolic rate plus 26.

Urine examination: Acid, specific gravity 1.026, albumin 1 plus, acetone 2 plus, sugar 3.3 per cent. Microscopic: Occasional pus-cell, occasional fine granular cast.

x-Ray examination shows calcified vessels of the left leg.

Diagnosis.—Exophthalmic goiter, diabetes, diabetic gangrene. Patient refused operation upon thyroid.

Numerous reports of persistent glycosuria cured by thyroidectomy have appeared in the literature. These are probably cases of latent diabetes simply arrested, or cases of functional glycosuria with thyroid disease. Thyroidectomy undoubtedly improves the tolerance of a hyperthyroid diabetic by lessening his metabolic demands; it increases the efficiency of the insulin unit; it lessens the danger of his developing a diabetic coma, but it does not cure his diabetes.

Wilder reported the palliative effect of a myxedema developing in a case of juvenile diabetes, and showed that, as the metabolic rate was restored to normal by the administration of thyroxin, the diabetic symptoms returned. Iodin has no effect upon the tolerance of the simple diabetic, nor does it increase the insulin efficiency. Wilder has administered it to a large number of cases without changing their tolerance. We have administered it to 2 cases in the University Hospital with apparently no effect. It is also ineffectual in cases of diabetes associated with adenomatous goiter and hyperthyroidism, except where exophthalmic goiter coexists.

An accurate diagnosis should be made in every case of hyperthyroidism with glycosuria and one should decide whether he is dealing with a true diabetes, with hyperthyroidism, or a hyperthyroidism with a functional glycosuria. To subject a hyperthyroid patient with this type of glycosuria to rigid dietetic restrictions is the opposite of the treatment indicated. Total dietary restriction in a true diabetic slows his metabolism and lessens the strain upon his pancreas. Placing a diabetic upon a maintenance diet (about 26 calories per kilogram) helps to desugarize him, but this diet for a hyperthyroid diabetic of the same age, size and sex, with a metabolic rate elevated, would amount to a starvation diet and would eventuate in marked weight and strength loss. Therefore, in arranging the total diet for a hyperthyroid diabetic one must take into consideration the proportion of increase of the basal metabolic rate, give

sufficient food to make up the difference, and take care of the increased food-intake by an increase in insulin dosage if necessary.

The importance of accurate diagnosis is well illustrated by the following report:

Mrs. G., aged forty-three. A diagnosis of exophthalmic goiter had been made late in 1926. She entered the hospital October 23, 1927, in a typical thyroid crisis, temperature 104° F., pulse 160, cold clammy skin, urine normal, and with a history of having been under the care of another physician who, having found a trace of sugar in the urine and normal blood-sugar in January, 1927, had treated her as a diabetic in the intervening period. The patient died in thirty-six hours, although Lugol's solution by mouth and by rectum was given in heroic doses and glucose solution was given intravenously.

Conclusion.—Those cases in which the combination of hyperthyroidism and diabetes occur demand the most careful attention. To allow them to continue with the glycosuria is to invite the danger of diabetic coma. The increase in metabolic rate increases the caloric demand, and total dietetic restrictions are not advisable. Owing to the fact that there is a defective carbohydrate utilization, the dietetic problem is a difficult one. Large doses of insulin will be necessarily much larger than is required for the same patient without hyperthyroidism, for the efficiency of the insulin unit is impaired. In the exophthalmic goiter cases with diabetes, iodin will increase the tolerance and lessen the insulin dosage by slowing the metabolic demand. Thyroidectomy will do this more completely and permanently.

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A CASE OF SUBACUTE BACTERIAL ENDOCARDITIS

THE case which I will present and discuss with you, is that of a young girl, seventeen years of age, who was sent into the University Hospital from our Dispensary, with a diagnosis of rheumatic carditis. She has now been in the hospital one hundred sixty days, affording us liberal opportunity to observe the progress of her illness in detail. Upon admittance she did not appear particularly ill and, in spite of her pallor, the blood examination showed the hemoglobin to be 90 per cent. and a red blood-cell count of 4,350,000. She appeared listless and disinterested in her condition, and volunteered no spontaneous information.

Her two chief complaints were weakness and shortness of breath upon exertion. The shortness of breath was first noticed last winter, and she has gradually lost strength and weight since that time. She gives a definite history of frequent "colds" during the winter months, and recurring sore throats during the past three or four years. There is no past history of acute articular rheumatism or chorea until six weeks previous to admittance when her ankles became swollen, red, and tender on pressure. This condition continued for four or five days. Four weeks later her hands became swollen, and movements of fingers was painful. The swelling subsided, but left the hands and arms "weak."

She had measles, mumps, smallpox, and scarlet fever during childhood; and it is possible that the last mentioned disease may have played an important rôle as an etiologic factor in her carditis. There is nothing of significance in her family history.

We will first enumerate the essential points in the physical and laboratory findings. Upon entrance her color was a grayish white with a tinge of yellow. Libman, in one of his earlier articles on "subacute bacterial endocarditis" or "Libman's disease," places particular emphasis on the color, which he noted was a peculiar sallow white but with a certain amount of brownish-yellow discoloration which always led him to consider the possibility of bacteria in the blood-stream. While, in this case, the color was not characteristic at first, still, as we have observed it during her hospital stay, we have noticed a gradual change, approaching that described by Libman.

Clinical evidences pointed toward a heart lesion. There was a definite systolic murmur, best heard over the mitral area and transmitted toward the left axilla. The murmur did not obliterate the unduly accentuated first sound. There was also a soft diastolic murmur heard in the region of Erb's point, and a markedly accentuated pulmonic second sound. Cardiac hypertrophy, at this time, was not demonstrable, and the blood-pressure was 104/78. Inasmuch as there was no obvious hypertrophy, and the blood-pressure was within normal range, the diastolic murmur was interpreted as being due to mitral disease rather than to aortic insufficiency. There was no palpable thrill. There were no petechiæ found, no erythematous nodules on the skin, and no clubbing of the fingers. The leukocyte count was 10,300, with 83 per cent. polymorphonuclear leukocytes. The urine was negative for albumin, pus, and red blood-cells. With these findings there was no reason to doubt the admittance diagnosis of rheumatic carditis.

A blood-culture was taken upon dextrose brain broth, and in forty-eight hours the laboratory staff reported a positive culture for Streptococcus viridans. The Streptococcus viridans grows with too great difficulty to be a frequent contaminator, so it was felt that the culture had much significance. There have since been six further blood-cultures taken, and the viridans has been found in all.

A positive blood-culture and a definite heart lesion does not necessarily prove the presence of bacteria on the endocardium or

the heart valves. However, the association of these two findings should suggest a bacterial endocarditis until proved otherwise. One year ago we had a patient on this service who had the physical findings of an aortic insufficiency of unknown origin; tubercle bacilli in his sputum, and Streptococcus viridans in blood-culture. This man was in the hospital for three weeks, and discharged with a diagnosis of bacterial endocarditis. His wife recently informed us that he had gone to California where he is now doing manual labor.

It is interesting to speculate whether this was a culture contamination, or if the patient had bacteria in the blood-stream at that time and has recovered. Cases of recovery are rare and this is the only possible one in our series of ten which might be listed as a recovery. However, Libman in 300 cases has seen four recoveries, and in a series of 189 cases reported by Sir Thomas Horder there were four recoveries.

Fever is a constant finding in this disease. On entrance our patient had a temperature of 100° F. This continued fairly constant until the eighteenth day, when it rose to 103° F., coincident with which she developed pain in her left hypochondrium, probably of splenic origin. Subsequent to this her temperature became septic in character with afternoon rise to 103° F., but she failed to show further evidences of emboli. Up until this time no petechiæ had been found. There were no erythematous nodules, splinter hemorrhages under the nails, or tender digits as described by Osler. Nor was there any marked tenderness over the lower end of the sternum—a finding first described by Libman.

Her temperature began to subside on the fortieth day, but rose a few days later when she developed precordial distress and pain in her left shoulder. The spleen at this time was palpable and tender. Since then she has had periods of septic temperature, alternating with periods when her temperature would remain normal for several days. Her last exacerbation occurred one week ago when the fever suddenly rose to 103.5° F., and for the first time she showed demonstrable superficial petechiæ. Her fever has occurred in waves coincident with embolic phenomena.

There is nothing characteristic about the pulse rate except that it tends to oscillate with the temperature changes.

During her hospital stay the white blood-cell count has remained fairly constant between 10,000 and 12,600, with a predominance of polymorphonuclear leukocytes. Leukopenia is not a rare finding—sometimes being present throughout the entire course of the disease.

On entrance the red blood-cell count was 4,350,000, and showed no material change during the first sixty days. Since then there has been a progressively increasing anemia. The hemoglobin has decreased proportionately with the decrease in the red blood-cell count—this being characteristic of a secondary anemia. The anemia is probably due to damage to the blood-forming organs, and may become so alarming that transfusion becomes indicated. This was necessary in one of our cases where the red blood-cell count dropped to 1,200,000, with 15 per cent. hemoglobin.

Urinary findings are a constant phenomena especially late in this disease. Our patient's urine was negative up until one month ago, since which time it has shown daily traces of albumin with an occasional small shower of red blood-cells. Subacute glomerular nephritis is usually a late complication, and patients dying of subacute bacterial endocarditis usually have characteristic lesions in the glomeruli, as shown by Baehr who describes swelling of the endothelium of the glomeruli with consequent complete avascular destruction of the loops, resulting in the disintegration of the epithelium of Bowman's capsule, and the patient goes the uremic route.

Let us examine our patient for further confirmatory findings from the present status of her illness. She is a well developed young girl lying flat in bed, apparently very comfortable and uninterested in her surroundings. There is no dyspnea or orthopnea, and her only complaint is that of an occasional vague distress in her left hypochondrium.

She is extremely pale except for a very faint flush over each cheek. Her pallor has a peculiar grayish quality. The skin is soft, moist, and warm, but with no evidences of pigmentation.

The pupils and eye-grounds are negative. The conjunctivæ are rather pale, as one would expect with her amount of anemia. A small petechial hemorrhage may be seen in each lower conjunctiva. Her lips are slightly cyanotic, dry, and covered with herpes. There is also a cyanotic tinge to the buccal mucous membranes. The tongue is clean, the teeth in good condition, and the tonsils are very small, without crypts or injection. The thyroid is not palpable.

The chest is symmetric with equal expansion on both sides. The cardiac impulse is diffuse and the apex impulse can be felt in the fifth costal interspace, 9 cm. to the left of the midsternum. A soft systolic thrill can be palpated in the third left costal interspace just outside the sternal margin. By percussion, the left border of cardiac dulness is found 10 cm. outside the midsternal line in the fifth interspace. There is no demonstrable enlargement to the right.

A loud blowing systolic murmur is heard all over the precordium and transmitted into the left axilla, but not to the great vessels of the neck. It is heard best in the third interspace just outside the left sternal border, where there is also a soft, early, diastolic murmur. The pulmonic second sound is loud, snapping, and accentuated.

Earlier in our observation of these murmurs the diastolic was transitory in character and time. Of late it has become permanent and localized at Erb's point. This distatolic murmur associated with an increase in the transverse diameter of the heart, an accentuated second pulmonic sound, and with no peripheral evidences of aortic insufficiency, prompts us to interpret it as a Graham-Steell murmur of mitral stenosis.

There is not enough evidence to diagnose aortic insufficiency, but the aorta was involved in 5 of our 9 cases.

The finger-nails are cyanotic, and there are early changes characteristic of clubbed fingers. These finger changes have developed during her hospitalization. There is slight pitting edema of both ankles, without joint-pain or tenderness. The reflexes are normal.

At present there are no evidences of petechial hemorrhages

on her body or extremities. One month ago she showed small petechial hemorrhages over dorsal aspect of both feet. These occurred in small groups, were painful and tender. With this shower of emboli there was a sharp flare-up in her temperature.

We have used no radical measures in the treatment of this case, largely because of the lack of response to such measures in our other cases. We have relied particularly upon two drugs, salicylates and arsenic. Inasmuch as the borderline between benign rheumatic carditis and subacute bacterial endocarditis is ill-defined, we believe the salicylates should be thoroughly tried in all cases. The dosage of salicylates is usually too small. A grain of sodium salicylate per pound of body weight, as long advocated by Gifford, is usually not too great. We have used the salicylate up to 80 grains daily with no ill-effects. Ten grains of sodium bicarbonate is given with each 20 grains of sodium salicylate. Arsenic has been used in the form of sodium cacodylate, giving daily 5 grains intravenously at intermittent periods since her admittance. It is known that arsenic is retained for a long period in the serum and other body fluids, and repeated laboratory demonstrations have shown that the growth of streptococci of low virulence is inhibited by arsenic solutions. Sodium cacodylate has been used extensively by Billings and Capps for many years, and Capps has reported four recoveries out of 8 cases, one as long as five and a half years after this treatment. Quinin is a valuable drug. We have used gentian-violet, 5 mg. per kilogram of body weight in 1 : 500 aqueous solution several different times in one of our patients. We were stimulated by the report of recovery under the intravenous use of this drug by Major, who reported three negative cultures in a proved case after one injection of the standard dose. Intravenous mercurochrome has been tried and found wanting. One of these cases had a cerebral embolus twenty-four hours after such management. Autogenous vaccines have shown poor results. Transfusion is at times indicated even though the blood-count is not greatly below normal, and cases have been recorded where the organism have temporarily disappeared from the blood-stream for a short period.

As in many other diseases, a satisfactory treatment has not been found and a specific therapy is yet to be developed. The removal of all proved foci is good medicine, at least in the early stages of the disease, and prophylactic measures directed toward rheumatic fever might prove the solution of this grave problem before us.

Dr. M. C. Andersen and I have reviewed 9 recent cases of bacterial endocarditis from the wards of the University of Nebraska Hospital. It was found that all the cases had a positive blood-culture for Streptococcus viridans before death. Five of the cases went to autopsy, the remaining three died shortly after their discharge from the hospital; however, we were able to obtain a fairly accurate statement concerning their subsequent progress.

The average age at death was twenty-eight years, not including 1 case (age sixty-three years) who developed chills and a septic temperature in the Hospital ward following a herniotomy operation, the operative wound becoming septic and the patient dying two months later. His blood-culture before death was positive for Streptococcus viridans, and an autopsy showed characteristic vegetative growths on the upper surface of the anterior leaflet of the tricuspid valve, and a heavy vegetation on the lower surface of the anterior leaflet of the mitral valve, with some stenosis of that valve.

In 4 of the cases the first symptom noticed by the patients was shortness of breath. Two became aware of their impending illness because of their increasing weakness and loss of weight. One patient entered the hospital in an attack of acute rheumatic fever, while the remaining case came for herniotomy and hemorrhoidectomy, and gave no symptoms suggesting bloodstream infection previous to his operation.

Six of the cases gave a history of heart lesions diagnosed earlier in life. Four gave a definite history of acute rheumatic fever, but only two of these gave histories of previously diagnosed heart lesions. All showed clinical or postmortem evidences of more than one heart-valve involvement. In only 1 case was there no evidence of mitral disease, autopsy in this case showing

a congenital heart lesion with a large vegetative mass lying on the wall of the right ventricle just below the pulmonary orifice, and lining the upper margin of a patent septum membrane (2 to 3 mm. in diameter), leading into the left ventricle. Of the different valves involved: the mitral valve seven times, the aortic five, the tricuspid three, and the pulmonary one. In 4 cases there were both aortic and mitral lesions, and in 3 there were both mitral and tricuspid lesions.

Clinically, only three showed superficial petechiæ, while the spleen was palpable in all except 1 case. In all, except one patient who left the hospital two weeks before his death, there were evidences of progressive kidney damage. The urine showing increasing amounts of albumin, casts, and red blood-cells.

All had a progressively increasing anemia, the lowest red blood-cell count recorded was 1,220,000 per cubic millimeter with 15 per cent. hemoglobin. In the case of the patient who developed his bacterial infection on the ward as a result of an infected postoperative wound, the red blood-cell count began to drop three weeks after operation, and in twenty-eight days had gone from 4,800,000 to 2,500,000; his hemoglobin dropping from 85 to 45 per cent. He also entered with a negative urine which subsequently showed increasing amounts of albumin, up to 3 plus, with many red blood-cells and pus-cells.

Four of the cases had a normal or subnormal white blood-cell count throughout their hospital stay, and all 8 cases showed a relative increase of polymorphonuclear leukocytes over the mononuclear cells, as shown by the stained blood-smears. The average white blood-cell count was 9850 per cubic millimeter, the lowest count recorded being 2200.

All carried a septic temperature with afternoon exacerbations during their hospital stay. There was a distinct tendency to a relative increase in the pulse rate over the temperature in the temperature-pulse ratio.

The average duration of the illness, *i. e.*, from the time of the first sign or symptom suggesting blood-stream infection until death, was one hundred and seventy-three days; the shortest period being fifty-six days, while the longest time of illness was

three hundred and fifteen days. The average time spent in the hospital was 58.5 days.

Four of the cases died suddenly from cerebral emboli, the remaining four succumbing to a progressive cardiac decompensation and final cardiac failure.

Libman has made more contributions to this subject than any other writer, and it is fitting that he should be honored by the name (Libman's disease) as the condition was reported by him in 1910. German and French writers used the term "endocarditis lenta" and Schottmüller reported 5 cases the same year that Libman presented his first 75 cases. The literature on this subject has been very extensive since the World War, and it is probable that the pandemics of influenza since that time have been the great reactivators. Bierring reports a definite history of influenza in 20 of 30 cases. The Streptococcus viridans has been the organism in 95 per cent. of the cases, although the influenza bacillus and the Micrococcus catarrhalis have been grown.

Libman's careful study of large numbers of hearts has shown that ulceration rarely occurs and when present is usually limited to the aortic flaps, hence the pathologic term "ulcerative endocarditis" should not be used to describe this entity.

The lesions may be large or small, but are always larger than the verrucous lesions of rheumatic fever. Chorda tendinæ may be severed by this productive inflammatory process. The vegetations are composed of blood-platelets containing large numbers of streptococci, especially on the surface. In some cases both fresh vegetations and old healed, even calcareous lesions, may be found, showing that recovery is possible. Some writers divide the disease clinically into the bacterium-free stage and the second, or embolic stage.

It is difficult to determine the difference between simple rheumatic carditis and the bacterium-free stage, and some observers believe that subacute bacterial endocarditis is simply a complication of a simple rheumatic endocarditis. Until the actual cause of acute rheumatic fever is proved, the relation between these two conditions cannot be clearly understood.

Our case has not yet shown many of the findings recorded in the embolic stage, as painful subcutaneous erythematous nodules, tender fingers and toes, splinter-hemorrhages, atrophic disorders of the digits, although she does have a beginning of clubbed fingers and a palpable spleen. The Osler nodes represent lesions which have resulted in the lodgment of minute emboli in the superficial terminal vessels. Osler described these lesions as painful, ephemeral, erythematous nodules with a diameter of $\frac{1}{2}$ to $1\frac{1}{2}$ centimeters, occurring mostly on the fingers and generally disappearing in some hours to a day. They occur most often on the pads of the distal phalanges, and are embolic in origin.

Our living patient (all the others are dead with the one possible exception of the man who is now living in California), has been in the hospital a longer period of time, and her total time of illness has been longer than any of the other cases; and although the prognosis is bad, recovery is yet possible.

The most common causes of death are glomerular nephritis with uremia, progressive anemia, gradual cardiac failure, intercurrent infections, more particularly pneumonia, and cerebral embolism. In our cases cerebral embolism heads the list.

We have said very little to you today about the relation of focal infections to this disease, merely stating that the removal of all proved foci in the early stages of the disease is good medicine. A review of our own cases as well as a review of all recent literature shows us that a bacterial endocarditis is almost always engrafted upon an old endocardial lesion.

Since 1915, when I heard conservative Richard Cabot say that an infected tonsil is a menace to any individual with heart disease, I have felt that the eradication of all areas of infection in any part of the body is indicated, whether it be apical abscesses, infected tonsils, infected sinuses with retained secretions, prostatic infection, or even infected gall-bladders, providing there is no definite contraindication to surgery.

Cardiac failure in my opinion is more often caused by reinfection of previously damaged valves or myocardium than by heart strain, and I do believe that many cases of subacute bac-

terial endocarditis can be prevented by surgical elimination of cesspools from which bacteria or their products find their way into the blood-stream.

Addendum.—This patient died at 12.20 A. M. February 2, 1928. She had a usual day, and at 12 midnight was seemingly comfortable at the time her temperature was taken. When the nurse returned to recover the thermometer, she found the patient lying face down. Her color was waxy white, and she was apparently unconscious. When the interne arrived she was practically pulseless, but still breathing. Cardiac stimulants were administered with no avail.

Autopsy performed the following morning showed the body of a young white girl in a fairly good state of nourishment and development. The skin has a pale yellowish tinge. The scleræ are clear, the pupils are uniform in size. There is no pitting of the ankles. A small petechial hemorrhage is seen beneath the thumb-nail on the right hand. A scattering of small hemorrhages is seen in the right lower leg. There are no petechiæ seen in the conjunctivæ. The nails of the fingers are somewhat curved.

There is some excess fluid in the peritoneal cavity, estimated to be about 100 c.c. The liver is 4 cm. below the costal margin, and the lower pole of the spleen is just presenting at the costal margin on the opposite side. The dome of the diaphragm is in the third interspace on the right side and at the fourth rib on the left.

Each pleural cavity contains an excess of clear straw-colored fluid, estimated to be 100 c.c. There are no adhesions. The pericardial cavity contains 150 c.c. of similar fluid.

The heart measured *in situ* extends 6.5 cm. to the left and 5 cm. to the right of the midsternal line. The vertical diameter is 8.5 cm. It weighs 320 gm. The heart muscle is soft and has a cloudy appearance. It is not thicker than normal. The aortic, tricuspid and pulmonic valves are normal, and capable of closing their respective orifices. The mitral valve, however, has a large friable vegetative growth upon its leaflet. A portion of this vegetation has become partially freed, and is hanging from the

lower margin of the valve. The border of the valve is somewhat thickened and deformed so that it very likely was somewhat incompetent. Culture of blood from the heart showed Streptococcus viridans in seventy-two hours.

The aorta is of normal size, there are no dilatations and the intimal surface is smooth.

The lungs are subcrepitant throughout, are very much heavier than normal. The right weighs 830, and the left 620 gm. There are no evidences of recent infarction on the external surface. The sectioned surface shows swelling and edema of the tissue, and a uniform color of passive congestion. In the parenchyma of the right upper lobe are numerous hemorrhages 3 to 6 mm. in diameter. These are scattered throughout the tissue, and are not wedge shaped.

The mucosa of the stomach and duodenum is free from ulcer or scar. The appendix is present, is small, not inflamed, and there are no bands of scar tissue about it. The mesenteric lymph-glands are enlarged up to 2 cm.

The liver weighs 2350 gm. The outer surface is dark red from congestion. The cut surface is likewise congested, and the tissue itself is very soft and friable. There is a cloudy swelling grossly.

The spleen weighs 800 gm. The outer covering is ragged from the tearing of adhesions to surrounding structures. The splenic substance is very soft; the sectioned surface bulges markedly from the capsule, and the pulp is greatly increased in amount, being easily scraped off on the edge of a knife. There are several scarred areas seen on the outer surface the result, no doubt, of old infarcts.

The kidneys look larger than normal. The right weighs 230 gm. Opposite the hilus of the right kidney is a large puckered indentation, site of an old infarct, and at the similar site in the left kidney is a similar but longer scar. The capsule strips readily leaving a smooth surface in which a diffuse scattering of minute petechiæ may be seen. The sectioned surface of the kidney bulges slightly. Scattered throughout the parenchymal tissue are numbers of small white dots, sites of tubular degenera-

tion and infection. Purulent material may be expressed from the parenchymal tissue and is seen to lie in the pelvis of the kidneys. No purulent material is seen in the lumen of the ureters.

The uterus is small, the tubes and ovaries are present. The fimbriated ends of the tubes are patent, there is no evidence of inflammation.

The bladder is opened and on the floor of the bladder, lying on the trigone, is seen a collection of what appears to be almost pure pus, about 4 c.c. in amount. There is no urine present. The wall of the bladder is not grossly inflamed nor ulcerated. Smears from this pus showed many pus and epithelial cells but no bacteria. Culture planted on blood-agar plates showed no growth at the end of twenty-four hours.

The head is opened in the usual manner, and the brain removed. There is no excess of cerebrospinal fluid present. The hemispheres are symmetric in size and consistency. There is nothing found, either on the external surface or on a few cross sections made, to account for the sudden death. The brain is placed in formalin for hardening, and further examination is deferred.

The middle-ear cavities and the mastoid cells are examined for infection, but none is found.

Anatomic diagnosis:

1. Acute suppurative nephritis.
2. Pyuria.
3. Mitral vegetations.
4. Cloudy swelling of viscera.
5. Old infarcts, spleen and kidneys.
6. Petechial hemorrhages in skin and beneath nail of right thumb.
7. Petechiæ, upper lobe, right lung.

There was nothing found at autopsy which would satisfactorily explain the cause of her sudden death, unless the cloudy swelling of all viscera including the heart muscle could have precipitated sudden heart-failure.

CLINIC OF DR. JOHN F. ALLEN

UNIVERSITY OF NEBRASKA, COLLEGE OF MEDICINE

A CONSIDERATION OF TWO CASES REPRESENTING WIDELY DIFFERENT TYPES OF PULMONARY TUBERCULOSIS

I AM presenting today 2 cases of pulmonary tuberculosis representing widely divergent types clinically and pathologically. The first is that of an acute, pneumonic tuberculosis, having had its onset rather abruptly, approximately two and one-half months ago. This case is now, in reality, near termination. In contrast to this, the other case has a history extending over several years, and represents a chronic, possibly avirulent type of infection, in which the pathology over a period of years has remained absolutely localized in the top of one lung, and has finally resulted in the formation of what I am inclined to designate as "lung stones."

Case I.—In presenting the first case, you will observe a young woman, approximately twenty-five years of age, and unmarried. The history as obtained indicates no previous illness of serious moment, although she suffered the ordinary, more common diseases of childhood. There is, in the immediate family, no history of tuberculosis. A young lady who was graduated here recently in medicine is a sister of this patient. The patient, who has been employed for the past two years in a local department store where she worked in the basement (and I do not mention this as of any significance, necessarily), changed her place of employment about three months ago, and was working, at the time of the onset of her present illness, at the Douglas County Hospital. It may be said that up until the actual day of the onset of her present complaint she had

enjoyed manifestly good health in every sense of the word, and her physical appearance so indicated.

On September 22d, she first complained of a chilly sensation, followed by acute pain of a pleuritic nature in the upper portion of the right chest, and a temperature of approximately 100° or 101° F. Fortunately, from the standpoint of a technical consideration of the case, *x*-ray films of the chest were immediately obtained. She was at once confined to bed. The pleuritic pain in the upper chest required strapping. By the fourth or fifth day the temperature range was up to 103° F., and when seen by me for the first time, on the fifth day, there were characteristic, gross physical findings of pneumonia. From this time, as you will note by the chart, the temperature range for approximately six weeks was up to 104° F. daily. There was practically no cough during the first two weeks of the course of the disease. The white blood count taken first on the third day, and repeated frequently thereafter, showed an absence of leukocytosis, in fact a slight leukopenia, until the last few days when it has risen to 11,000. There has been a slight lymphocytosis, the polymorphonuclears not showing above 60 per cent. on any count. The pleuritic pain subsided within a few days and for the first ten days or longer, dyspnea, cyanosis, and the presence of sputum, ordinarily characteristic of non-tuberculous pneumonias, were not present. After the subsidence of pain, and well past the time for the crisis of a severe, non-tuberculous pneumonia, this patient manifested a fairly comfortable condition both physically and mentally.

My intention and purpose in connection with the presentation of this case is to call attention to the basis upon which an early, correct diagnosis was made, to its classical clinical couse, to the inevitable, practically fatal prognosis, and to the equally characteristic, psychologic reaction of the patient's family to the situation. In addition to these points, the rather complete data bearing upon the case, especially the series of chest roentgenograms, renders it possible to present an individual case in connection with which certain observations may be permissible bearing upon one of the problems of tuberculosis which is at the

present time being accorded the most serious consideration. I refer to the question of whether adult clinical pulmonary tuberculosis is exogenous or endogenous.

The first consideration is diagnosis. As I have previously stated the patient was not seen by me until the fifth day of her illness. At this time there were characteristic physical findings of a right upper lobe pneumonia. While one may be suspicious that upper lobe pneumonias may prove to be tuberculous, and an absence of leukocytosis may make the suspicion more warrantable, a positive diagnosis cannot be made ordinarily except as a result of the prolonged course of the disease beyond the ordinary period of a pneumonia, and ultimately by the discovery that the sputum contains tubercle organisms. In such cases, ordinarily a diagnosis of tuberculosis is only reached after a period of from four to eight or even ten weeks, as many of us will appreciate by thinking back over our actual experience with similar cases.

In this instance, I was enabled on the fifth day of the disease, when the case was seen for the first time, to express the positive opinion that the condition was an acute pneumonic tuberculosis. The one consideration upon which I considered such diagnosis justifiable beyond question was the *x*-ray film taken on the day of onset of the illness. You will note in this film a characteristic shadow in the right upper lobe, which is not that of a pneumonic process such as you see in the film taken five days later, but is one characteristic of a tuberculous lesion of considerable duration. It is not the picture of pneumonia. It is the picture of tuberculosis: of pathology present before the actual pneumonia had developed. It is so typical and so classical as to leave no doubt of its character. With a pneumonic process, manifested classically on the fifth day, both by physical signs and *x*-ray film as shown in Fig. 71, there could be no doubt nor uncertainty as to the nature of the condition. I will refer later to the presence of the pathology shown in the first plate in discussing the fourth point which I previously mentioned; namely, the matter of exogenous or endogenous infection.

Referring to the classical course of the disease, you will note that for a period of practically six weeks, the temperature range has been up to 104° F. For the first three weeks the patient was mentally clear and without serious physical discomfort or distress, with the exception of the acute pain at onset. Going into about the fourth week she began to be irrational at night, loss of weight became noticeable, there developed the absolutely dry tongue characteristic of prolonged toxic states, generally referred to as a manifestation of acidosis, cough became paroxysmal and very disturbing, and there was considerable abdominal distention. By the fifth or sixth week a marked cardiac irregularity developed. There was practically no expectoration during the first two weeks of the illness, a rather small amount during the third week, and even up until the present time the total amount of sputum is not more than a couple of ounces a day. It has at no time been sanguineous in character. During the third week, upon examination of the third specimen, tubercle organisms were reported present by the laboratory. For at least two weeks, and up until within the last few days the patient was in a semiconscious state, during which she could be aroused and would at times reply slowly to questions if they were repeated and emphasized. Her appearance and condition resembled very much the so-called "typhoid state" which we formerly spoke of so often, except that at times there was a more active delirium. Food has been taken under the same circumstances fairly liberally. For the past two weeks there has been a clearing of the mental state, and a slight but definite decrease in the temperature range. At the present time the patient is fairly clear mentally, at least during the day. There developed some ten days past indications of a phlebitis in the left leg. This has somewhat subsided at the present time, but you will note that there is still some swelling below the knee and into the dorsum of the foot. At the present time, this girl has passed the period of prolonged hyperpyrexia, and it is here, at this point, where friends and relatives, having closely watched the progress of an illness which by them was expected to terminate fatally three or four weeks ago, are liable to look

upon the case as improving or even entering upon a period or stage of convalescence. In reality, what we actually see is a case which will in all probability terminate fatally within the next two to six weeks as the result of a prolonged toxic exhaustion. Resolution of the pathologic process as the result of an immunization brought about by the development of immune bodies, by the formation of antibodies, or as a result of anti-

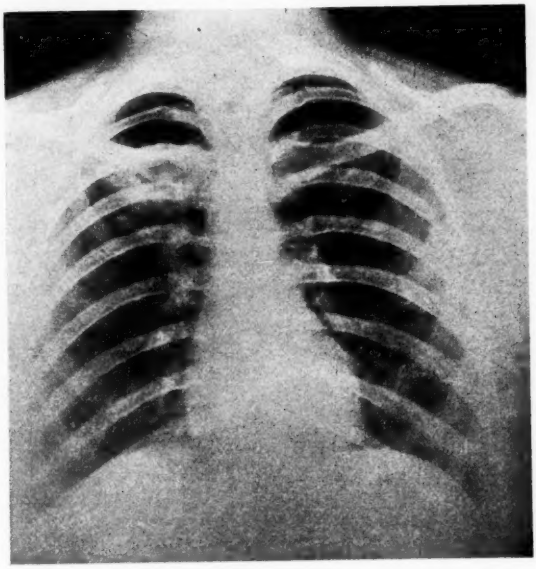

Fig. 71.—Case I.

toxic properties of the blood, as presumably occurs in ordinary pneumonias, does not occur in tuberculous processes.

I wish now to call your attention to the series of *x*-ray films (Figs. 71–74) which show, first, the original disease, second, the establishment of a dense pneumonia of the right upper lobe, then a rapid dissemination into the right lower lobe with practically complete involvement and, finally, the distribution of the process into the left lung. The actual amount of elapsed time from the date of the first picture to the

date of the last one is thirty-five days. The actual time from onset of the illness to the present time is seventy-nine days.

Speaking briefly with reference to treatment, it can only be said that this included symptomatic and supportive measures. The acute pleurisy at onset required an attempt at strapping of the upper chest. Good hygienic surroundings and nursing were provided. Morphin has been consistently required and, during the height of the fever and delirium and exhausting attacks of

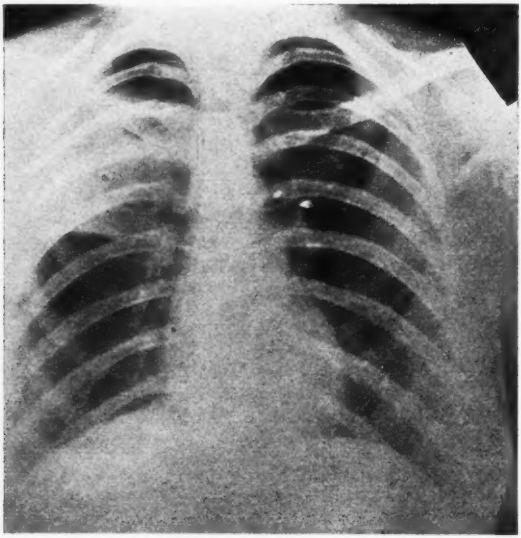

Fig. 72.—Case I.

cough, $\frac{3}{4}$ grain every twenty-four hours were administered hypodermically, and in addition occasional sedatives, especially a few doses of heroin, were administered. For about four weeks, 500 c.c. of 10 per cent. glucose in 2 per cent. soda solution were administered per rectum, twice daily. It was well taken and, judging principally by the condition of the mouth and tongue, was quite effectual. Digitalis was begun first on the twenty-eighth day, and has been rather regularly administered until

the last few days. There were a few days when, owing to the extreme irregularity of the pulse and the absence of tone in the heart-sounds, caffein was given and digifolin hypodermically as emergency measures. A diet of high caloric value was given, but there was a period when this was mostly liquid in form.

I have now two more points of my original four to discuss. The first one refers to the disposition of this case at the present time. This will be determined rather characteristically or really,

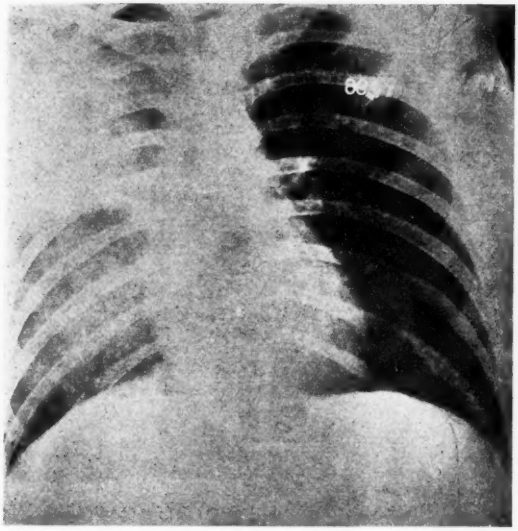

Fig. 73.—Case I.

I should say, has already been determined by the decision of the family, based upon the plaintive request of the patient and their own perfectly natural reaction thereto. This patient is to be transported next week to Arizona in the futile hope that she will there regain her health. Recognizing that the emotions are often far more influential factors in life than the will or the intellect, I have not presumed to advise against such procedure nor to encourage or discourage. I have simply advised that I

do not believe that the patient will die *en route*, but that the ultimate outcome will be influenced none whatever.[1]

What, if any, special technical or scientific interest attaches to the case is, in my opinion, related to the question of whether the clinical forms of pulmonary tuberculosis seen in adult life are the result of recent, newly acquired infection coming from the outside through contact with other victims of the disease; or whether they simply represent pathologic processes which

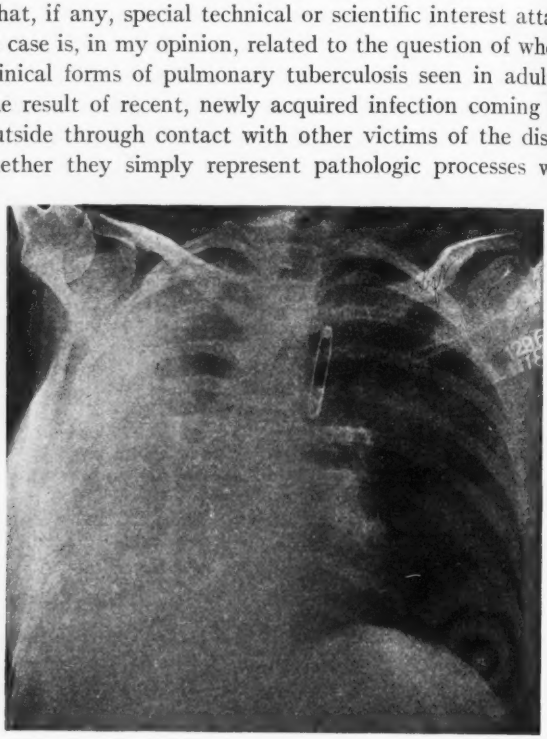

Fig. 74.—Case I.

are to be referred back to a preëxisting focus, to the original or primary infection of childhood, or to a previously long-existing lesion from which no clinical manifestations have earlier arisen.

Not so many years back, after the idea of the rather universal infection of childhood became widely and generally accepted, there followed a period during which clinical disease in the adult was considered practically always, if not entirely, a

[1] This patient arrived in Arizona five days later, on December 15th, and died on January 3, 1928.

condition resulting solely from the previous infection. That is, adult clinical disease of the lungs was simply considered to be the result of the spread from within of infection from an original focus, an endogenous process. It was widely accepted and taught that adult disease did not and could not arise as a result of infection from the outside of the body. This meant theoretically that the original infection of childhood immunized the individual against further exogenous infection, and from the practical standpoint, that adults were safe or immune from the disease under all circumstances, provided they had received their accidental inoculation in childhood. Why an individual should be immune to tubercle organisms which might enter the body in adult life from outside sources, and yet ultimately fail to maintain the same degree of immunity against organisms harbored in his own body is but one of the innumerable more or less logical objections which have been directed against the theory. There has been, however, in the last ten years a definite reaction against the acceptance of the idea that the adult cannot acquire tuberculosis through exogenous infection and, at the present time, the probable concensus of opinion would admit that a definite percentage of adult clinical disease is the result of a new infection acquired from the outside, either because of a lowering or actual loss of the immunity resulting from the original infection, or because of the opportunity for massive dosage. Massive dosage, in common terms, means intimate, prolonged contact with open tuberculosis. Upon the question of the comparative percentage of exogenous or endogenous infection, however, very few probably would care to commit themselves. Based upon the work of Dr. Opie more than any other, the idea of adult clinical tuberculosis being the result of an entirely new and separate acquired condition has within the last few years gained ground remarkably. It is a beautiful example of the pendulum-like swing of authoritative opinion on matters medical and scientific.

Dr. Opie believes that in many instances pulmonary tuberculosis of adult life is in no way related to the earlier infection of childhood, but is an entirely new and distinct episode. He has

done extremely important work in support of this theory, and his influence has been very pronounced in its effect upon the present-day conception of the situation. Time will not here permit any detailed reference or discussion of the matter.

By a rather devious route and perhaps laboriously, I have arrived at the point which I had wished to develop in the case which we are considering. Quite briefly, for want of time, I wish to call your attention to the following points concerning this case. First, this girl became suddenly ill within about two weeks after starting to work in the County Hospital. The County Hospital is looked upon by the laity, and perhaps by others, as a place where tubercle organisms are literally swarming. A priori, it was here that she acquired the disease. Second, in this type of tuberculosis *x*-ray observations have not ordinarily been obtained previous or prior to the time when the pneumonic process is actually present. As a matter of fact, Fig. 72 in this case was taken much earlier than would have occurred under the usual conditions of practice. Third, without the *x*-ray film taken on the first day of the disease, there would have been no way by *x*-ray examination or otherwise of determining whether or not this condition was in any way related to an earlier focus or whether it was, on the other hand, a condition arising from exogenous infection. Fourth, the *x*-ray taken on the first day, however, shows the presence of a classical tuberculous lesion which could not be interpreted otherwise than one of considerable duration. And fifth, it must be concluded that the present illness is simply a new and final phase in a much older struggle which has been going on between the processes of infection and immunity in this girl's lung. The case is one in which a rapidly progressive, pneumonic, pulmonary tuberculosis of sudden onset in an individual, always previously in apparent good health, developed under environmental surroundings which would incline one's thought to the possibility, or even probability, that exogenic infection was the exciting cause. The *x*-ray observations showing a characteristic focus or lesion which cannot possibly be interpreted as new or recent, antedating the actual pneumonia and the development of a pneumonic process contiguous to it, are facts which clearly disprove any such idea.

Case II.—My second case today, which can only be discussed briefly, is in marked contrast in all respects to the one we have just seen. It represents an entirely different type of pathology with a correspondingly different history. It is not pure tragedy, as in the first instance. The actual history of the case relating the patient's experience is probably the principal thing of interest, together with the *x*-ray film which gives an accurate idea of the pathology.

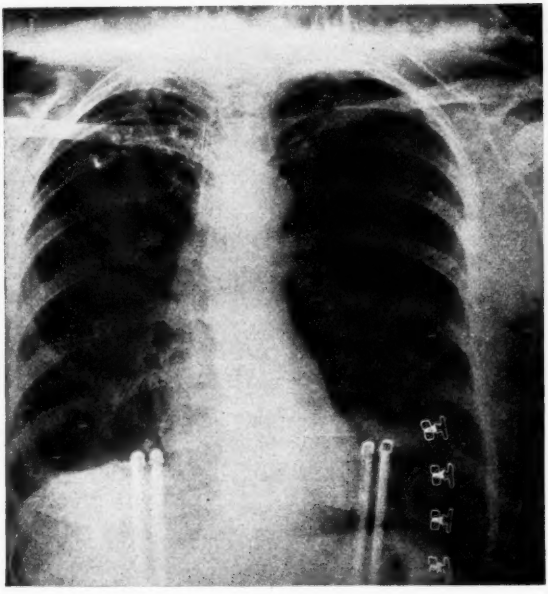

Fig. 75.—Case II.

This patient, an unmarried school teacher forty-seven years of age, was first seen by me in May, 1924. The history states that she had pneumonia in 1917, being critically ill, bronchitis in 1918, influenza in 1919, a similar attack in 1920, and a "terrible cold" in 1921. In the spring of 1922 she was advised by a prominent physician that she had tuberculosis. Prior to the history related, her normal weight had not averaged above 115

pounds. At the time of the first diagnosis of active tuberculosis her weight was about 140 pounds. The findings upon which the diagnosis was established are not available. Upon her physician's advice, at that time, to give up teaching and go to California, she retired from teaching and remained here in town. For practically two years she consulted no physician, merely "reading up" on the subject of tuberculosis, and observing the simple teachings of rest with plenty of food. When she first consulted me, her weight had increased to 170 pounds. There had been from the beginning, however, practically no change in the character or amount of sputum, which had never been very considerable. The physical signs which are recorded at that time were lagging, changed breath sounds, and increased conduction, right top. Sputum, negative for tubercle organisms. Three months later she returned for a brief examination. Findings were unchanged. In each instance only a cursory examination was permitted. Again for a period of about eight months this patient was not seen, but when she returned in May, 1925, I prevailed upon her to permit me to make some more detailed observations.

The sputum, which from the beginning, according to the patient's statement, had not varied in amount or character, was homogeneous, greenish, macerated, and practically liquid. The *x*-ray disclosed the presence of calcified stone-like bodies in the upper right lung field, with very little surrounding tissue changes. This together with the persistence of sputum of an atypical character aroused a definite doubt in my mind as to the tuberculous nature of the lesion. Tuberculous lesions going on to calcification do not continue, as a rule, to produce sputum. You will note in the *x*-ray shown, which, although very recently taken, shows no material change from the one of two and a half years ago, the calcified areas distributed from about the midportion of the upper lobe into the extreme apex. These are not calcified glands. They look almost like shrapnel.

Many sputum examinations were made. All were negative. Finally a guinea-pig was inoculated by Dr. Neihaus. The animal was killed six weeks later and no tuberculous lesions were found.

By this time I was harboring a rather fantastic idea that the lesion was not tuberculous; that some other type of infection was responsible for the formation of "stones" in the parenchyma of the lung, and that they were lying, each in a little individual pocket, from which the purulent secretion was producing the peculiar type of sputum. Attempts to determine by cultural methods a predominating organism met with no real success, although there was a great variety of organisms present, including streptococci, pneumococci, staphylococci, and so forth.

Finally the patient, having been advised by me that she might return to work under observation, consulted a prominent clinician who, after examination, informed her that her disease was healed. He, however, advised a relative that "there wasn't a damn thing the matter with her." The viewpoint so plainly inferred by the latter remark was immediately adopted by the sisters of this patient with whom she was living. Being rather acutely conscious of this changed attitude, the patient resumed part-time work as a teacher and in addition carried on practically the entire work of the household, the sisters being also employed away from home.

Another six months elapsed, and in October of last year the patient again reported to me. She had lost precisely 50 pounds in weight, and on two occasions had expectorated a mouthful of blood. Being in a false position at home and rather under suspicion, she had maintained secrecy concerning the hemorrhages.

Rather to my surprise, sputum examination by the ordinary method at this time disclosed tubercle organisms. There was no change in physical signs in the chest or upon the *x*-ray.

These 2 cases are in striking contrast. They call our attention to the widely divergent pathology and entirely different clinical courses which may result from the tubercle organism as an infecting agent. Up to the present time, it would not appear that there is any satisfactory explanation relating to the forces or influences which may determine the course of tuberculous disease in the human lung. The best students of the problem must resort to vague, inadequate generalizations.

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VALUE OF LEUKOCYTE COUNTS ACCORDING TO ARNETH-SCHILLING FORMULA IN CLINICAL MEDICINE

THE enumeration of the leukocytes and the differential count are very common laboratory procedures, being surpassed in number only by urinalyses. It is also regarded as one of the simplest examinations. The authenticity of the reports is rarely questioned, and they are as readily accepted from the novice as from the most experienced. In fact, this examination is usually relegated to the least experienced technician or interne. Instruction is often carried only to the point of the theoretic consideration of filling pipets and counting chambers, and making blood-smears and stains. Internes supposedly have mastered the art, and are not further supervised. Technicians are considered qualified after their 100 counts have been completed. The competent, of course, will achieve a high degree of proficiency, the less capable will multiply their errors. These deficiencies are strongly impressed when one has occasion to examine blood submitted for an opinion, or on occasions of personally checking extraordinary cases. With this situation in mind, one can easily appreciate the difference in attitude between the zeal of the master hematologist, and the indifference of the average clinician.

It is not at all surprising, that the method suggested by Arneth in 1904 was only used and studied by competent hematologists. Obviously poorly made preparations which permit only differentiation of the polymorphonuclears from the lymphocytes and the mononuclears, are entirely unsatisfactory for this more detailed method.

Arneth based his study largely on the morphology of the nucleus of the neutrophil. He divided them into five main classes, viz.:

Class I. Neutrophils with a vesicular, round or slightly indented nucleus, also those with a simple but deeply indented nucleus, and granular cytoplasm.

Class II. Cells with the nucleus in two segments.

Class III. Cells with the nucleus in three segments.

Class IV. Cells with the nucleus in four segments.

Class V. Cells with the nucleus in five or more parts.

This formula was most frequently used, but in some instances as many as 81 subdivisions were made. This method was never used very extensively in clinical medicine.

Schilling of Berlin recently modified Arneth's method. His method is much simpler. In fact, with good preparations, it does not appreciably increase the time and the labor of an ordinary differential count, and markedly adds to its value. His classification of neutrophils is as follows:

I. Myelocytes. The nucleus is round, oval, or kidney-shaped; relatively large, vesicular, coarsely granular, usually has a nucleolus, and takes a pale stain. The cytoplasm is pale blue. The granulations are usually delicate, and stain faintly. They are normally found only in the bone-marrow.

II. Young forms (jugendliche). Normally many are found in the bone-marrow, rarely in the peripheral blood. The nucleus is sausage and bean-shaped. Its consistency is vesicular, and does not stain intensely. It is distinctly plotted, with striking nuclear granulations at the ends. The cytoplasm is like that of mature cells. At times it is light blue. Granulations are not so distinct. These cells are usually slightly larger than the mature cells. This class is, in part, identical with Pappenheim's "metamyelocytes."

III. Staff forms (stabkernige). The nucleus is T, U, or V shaped. The cytoplasm is fully mature. These forms make up 3 to 5 per cent. of the normal blood. Degenerative staff forms are apparently mature neutrophils without segmentation. On

account of a developmental inhibition, the sausage form does not divide into segments. They are differentiated from normal staff forms and young forms by a small band-like, often bizarre, twisted and always hyperchromatic (dark structureless) nuclear form. The granulations either easily overstain or stain sparsely or are partially dissolved. They are easily broken in smearing.

IV. Segmented Nucleus. The nucleus consists of 2 to 5 unequal segments. The latter are united by fine threads. Broader unions (bridges) are temporary attenuations of the nucleus, which are influenced by technic and ameboid movements. Only the former are classified as segmented. They make up 67 per cent. of a normal count.

The other forms of granulocytes are the eosinophils and basophils. Cells which are ordinarily classified as small lymphocytes are the only cells recognized as lymphocytes. Those white corpuscles usually classed as large lymphocytes are called monocytes. The transitional cells are included in this group. The monocytes are described as at least twice the size of a red blood-cell, usually much larger than a granulocyte. The cytoplasm is relatively wide, stains a smoky blue or pale violet color, and frequently contains small vacuoles. The nucleus is medium-sized, relatively large, oval, or bean-shaped, slightly eccentric, may even be sausage-shaped, or have plump segments.

Schilling, further, conceives the origin of white corpuscles from three sources (Trialismus) namely: The granulocytes from the bone-marrow; lymphocytes from the lymph-glands and the lymphoid tissue wherever found; the monocytes from the reticulo-endothelial tissue. The peripheral blood-picture reflects the functional status of these organs or tissues. Diseases attacking these structures themselves, or toxic agents arising from a disease in other parts of the body as from an infection, would modify the blood-picture. This is further influenced by destruction of leukocytes, so that two factors are at work, namely, productive and destructive (Ersatz and Verbrauch).

With a pyogenic infection there is a bone-marrow stimulation, causing increased production, and also an increased use of neutrophils before they reach normal maturity. The greater the

stimulus, the less mature are the cells thrown into peripheral circulation. So that first the number of staff forms is increased, then young forms and even myelocytes are found in the circulating blood. Coincident with this influx of immature forms, the cells are used (Verbrauch) before they reach maturity. In classifying these cells according to the nuclear form and consistency, a marked difference in the nuclei is evident. This is designated as nuclear deviation (Kernverscheibung). These are usually written from left to right across a page (myelocytes, young forms, staff forms, segmented forms). As the number of cells belonging to the groups on the left are increased, this condition is referred to as deviation to left (Links-verscheibung). Changes enumerated above are regenerative changes. Besides these some diseases and infections exert an influence which primarily inhibit the bone-marrow. These are degenerative changes.

With this conception in mind, certain blood-pictures indicate certain phases of disease or infection.

A. Slight stimulations produce only minor changes with a slight increase of staff forms.

B. A moderate stimulus shows a few young forms.

C. Strong excitants cause a marked increase of the young and even parent forms (myelocytes). Extreme stimulation may cause a central injury and a marked disturbance of peripheral cells; *i. e.*, extreme deviation to left.

Ordinarily, the leukocyte count is parallel with the severity of the infection, but with very grave infection a sudden fall may occur. In the latter instance, the decrease might be interpreted as an omen of recovery, but in reality it would be the reverse. The correct interpretation would be evident by a proper scrutiny of the individual cells. Undoubtedly many young forms would be present in the blood. This phase concerns only the neutrophils. When this ends favorably, with a return of the nuclear deviation to the right and a decrease of leukocytosis, there is an increase of monocytes. This denotes that the infection has been conquered. The healing phase is evidenced by a lymphocytosis. Eosinophils also disappear from the blood in severe infection, and their reappearance is the earliest favorable sign. On the

other hand, basophils appear only with severe infection, when the defensive factors are losing ground. They again disappear with earliest improvement.

Case I.—L. C., aged eleven years, case of Dr. Olga Stastny. He complained of a pain in the right shoulder for a few days. Then he suddenly developed a high temperature. In short, this proved to be a case of acute osteomyelitis of the left humerus at the junction of the upper epiphysis of the left fibula, and a suppurative arthritis of the right knee. Finally multiple abscesses of the skin formed. Blood-cultures showed a Staphylococcus albus. The patient died nineteen days after the onset of the disease. Leukocyte counts made during the first five days in the hospital varied from 11,800 to 17,700 per cubic millimeter, but were not differentiated according to the Schilling formula. The remaining counts were made according to this method, and are as follows:

Date.	Total W. B. C.	Bas.	Eos.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.
Nov. 10....	17,700	0	0	11	40	11	18	14	6
Nov. 11....	18,000	0	0	7	50	16	8	17	2
Nov. 12....	17,200	0	0	5	40	32	10	8	5
Nov. 14....	17,000	0	0	7	43	20	16	10	4
Nov. 17....	29,400	0	0	20	18	30	20	10	2
Nov. 19....	7,200	2	0	18	50	10	9	6	7

Relation of the blood-picture to the temperature chart is shown in Fig. 76. This is a case of extreme deviation to the

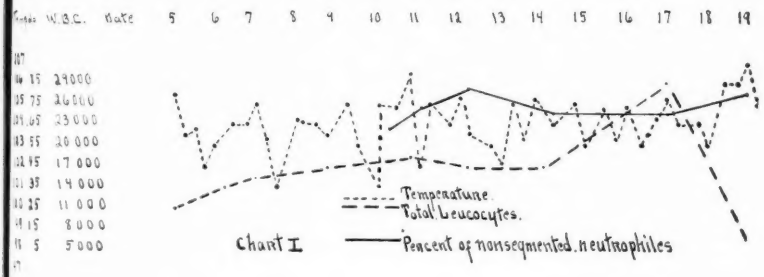

Fig. 76.

left, classified by Schilling as a myeloid blood-picture. The majority of the granulocytes in the blood-stream are cells normally found only in the bone-marrow. There is a marked outpouring of immature cells. The acute fall in the total leukocytes with an increase in nuclear deviation, together with the appearance of basophils, foretell a fatal termination.

Case II.—C. W. H., aged eight years, case of Dr. Clark. About one week before the onset of the illness, the child had a blister on his heel. Two days before entering the hospital he came home from school with a headache. His temperature at that time was 104° F. Two days later there was a paralysis of the left arm and the right leg. This, later, involved the right side of his face. There were petechiæ over the entire body. An abscess formed over the lower end of the sternum, and there were superficial abscesses on the tips of both little fingers. There was a pericardial friction rub. Albumin was present in the urine. Blood-cultures on two occasions showed blood-agar plates thickly "peppered" with colonies of Staphylococcus albus. Cultures from the vesicles and the abscesses showed the same organisms. The blood-counts were as follows:

Date.	R. B. C.	Total W. B. C.	Eos.	Bas.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.
Nov. 27.....	4,032,000	15,400	0	0	15	16	22	36	5	6
Nov. 28.....	.....	13,400	0	2	12	27	33	19	5	2

Figure 77 shows the relation of the leukocytosis, the percentage of the immature forms and the temperature. The patient died on the third day in the hospital. Necropsy findings were as follows: (1) Abscess of the brain. (2) Multiple abscesses of the kidneys. (3) Abscesses of the sternum and the calvarium. (4) Multiple abscesses of the lungs. (5) Acute suppurative pericarditis. (6) Acute vegetative endocarditis. (7) Purulent vesicle of the heel. The blood-picture shows a marked nuclear deviation to the left. On account of the paralysis, poliomyelitis was considered as a possibility. The blood-count was, at least, a factor in identifying the pyogenic nature of the disease.

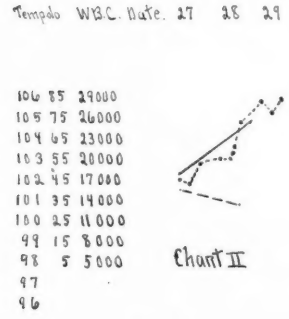

Fig. 77.

Case III.—D. H., aged five, case of Dr. W. H. Cassidy. About two weeks before admission to the hospital, the child had an otitis media, which perforated and discharged. He suddenly developed a high temperature (104° F.). At operation, the right mastoid showed suppuration. He developed cerebral symptoms. The spinal fluid showed 500 leukocytes per cubic millimeter. Streptococci were isolated from the spinal fluid. Patient expired after being in the hospital for four days. The blood-picture was as follows:

Date.	Total W. B. C.	Bas.	Eos.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.
Dec. 12.....	24,200	0	0	6	9	23	51	6	5
Dec. 13.....	32,000	0	0	8	20	30	36	4	2
Dec. 14.....	40,000	0	0	4	10	26	59	0	1
Dec. 15.....	21,000	0	0	7	20	30	30	6	7

Figure 78 shows relation of the blood-picture to the temperature. This shows a marked deviation to the left.

Case IV.—K. H., aged six, case of Dr. T. J. Dwyer. This is a case of acute appendicitis. At operation a pus cavity was found, extending from the appendiceal region to the inferior surface of the liver, with evidence of a general peritonitis. Free drainage was provided, but the patient died fourteen days after entering hospital.

Figure 79 shows the relation between the blood-picture and temperature. The leukocyte count made on admission was par-

ticularly valuable. Total leukocytes, 14,800; neutrophils, 65 per cent., which were classified as myelocytes 3 per cent., young

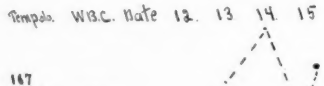

Fig. 78.

forms 20 per cent, staff 18 per cent., segmented 24 per cent. The total percentage of neutrophils would indicate a benign infection but, when considering the ratio between the segmented and the non-segmented forms, the blood-picture bespeaks a

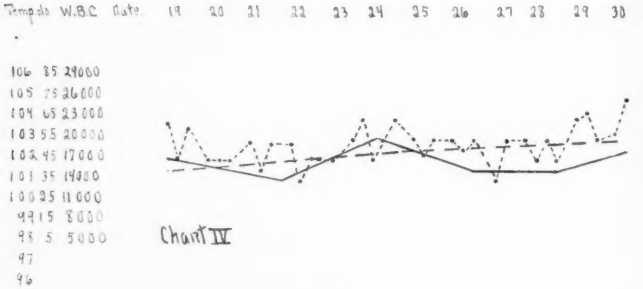

Fig. 79.

grave infection. The latter conclusion was corroborated at the operation.

Case V.—L. M., young adult, case of Dr. LeRoy Crummer. This is a case of lobar pneumonia, Type IV. The course is quite typical, ending with a crisis. He was fever free in ten days after the onset. The leukocyte picture is as follows:

Date.	Total W. B. C.	Bas.	Eos.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.
Dec. 14.....	19,200								
Dec. 15.....	14,400	0	0	5	8	24	39	12	12
Dec. 18.....	10,000	0	0	4	4	12	51	10	19
Dec. 19.....	10,000	0	0	5	10	16	47	14	8
Dec. 20.....	10,400	0	0	2	4	12	62	9	11
Dec. 21.....	10,400	0	3	0	0	3	68	16	10
Dec. 22.....	10,000	0	2	0	0	3	70	20	5

Figure 80 shows relation of the blood-counts and temperature. This case illustrates a marked nuclear deviation during the height of the infection, and a decline with the recovery. It also shows a return of the eosinophilia with the conquest of the infection.

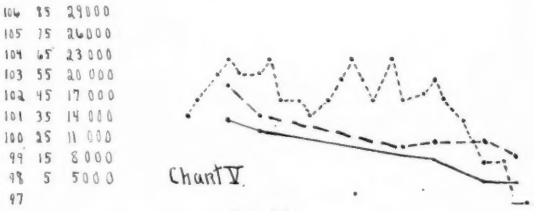

Fig. 80.

Case VI.—G. S., age three years, case of Dr. J. B. Potts. This is a case of bilateral mastoiditis. The course was very turbulent, but the temperature returned to normal on the fifth postoperative day. The blood-counts were are as follows:

Date.	Total W. B. C.	Bas.	Eos.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.
Jan. 21.....	24,500	0	0	5	15	26	31	14	8
Jan. 23.....	25,000	0	0	4	4	54	36	2	0
Jan. 24.....	21,800	1	0	1	5	30	29	32	2
Jan. 25.....	20,000	0	0	7	10	51	22	7	3 Hemorrhage.
Jan. 26.....	19,000	1	0	0	2	14	64	15	2
Jan. 27.....	11,000	0	2	0	0	7	63	20	8

On January 25th there was considerable bleeding, and the patient's general condition was poor. With the cessation of the hemorrhage, recovery was precipitant (Fig. 81).

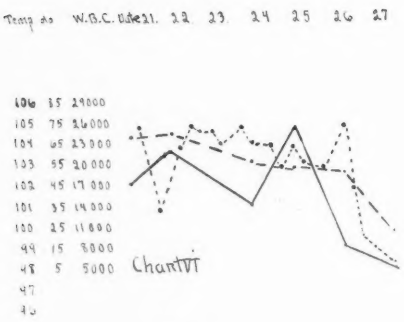

Fig. 81.

Case VII.—Mrs. C., case of Dr. J. B. Potts. This is a case of suppurative mastoiditis, with return to normal temperature six days after operation. The following blood-counts were recorded.

Date.	Total W. B. C.	Bas.	Eos.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.
Jan. 19.....	16,000	0	0	2	6	18	59	9	5
Jan. 20.....	15,800	0	0	2	6	22	41	22	7
Jan. 21.....	16,000	0	0	6	6	20	43	17	8
Jan. 22.....	16,000	0	0	3	14	29	33	18	3
Jan. 23.....	13,800	0	1	1	1	15	45	29	7
Jan. 24.....	11,400	0	0	0	2	13	46	35	3
Jan. 26.....	9,600	0	0	0	0	5	66	25	4

Figure 82 shows the relation of the blood-picture to the temperature. The nuclear deviation shifting back to the right with recovery.

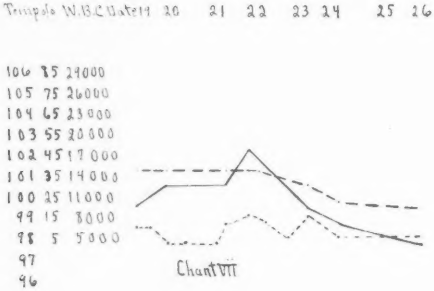

Fig. 82.

Case number.	Leukocyte count.	Bas.	Eos.	Myel.	Young.	Staff.	Segm.	Lymph.	Mono.	Diagnosis.
1	10,200	0	0	0	1	5	72	17	4	Postpartum, 10 days.
2										Acute appendicitis.
1 P. M.	15,800	0	0	0	0	19	70	6	5	
5 P. M.	16,800	0	0	0	0	16	77	5	1	Acute appendicitis.
3	7,600	0	0	0	5	26	63	6	0	Lung abscess.
4	9,600	0	0	0	1	15	74	10	0	Grippe.
5	8,400	0	0	0	0	19	50	30	1	Pyonephrosis.
6	8,000	0	0	0	0	12	49	39	0	Acute respiratory infection.
7	10,200	0	0	0	0	11	56	33	0	Preoperative mastoiditis.
8	10,000	0	0	0	0	15	59	26	0	Focal infection, arthritis.
9	12,400	0	0	0	0	11	56	33	0	Pregnancy.
10	12,600	0	0	0	2	9	54	35	0	Encephalitis.
11	23,400	0	0	0	4	11	69	16	0	Septicemia, abortion.
12	19,600	0	0	0	0	20	73	7	0	Pneumonia.
13	18,000	0	0	0	0	16	61	17	6	Acute appendicitis.
14	19,400	0	0	0	0	31	56	11	2	Lobar pneumonia.
15	10,400	0	2	0	2	8	54	34	0	Bronchial asthma.
16	20,000	0	0	0	0	20	71	9	0	Acute appendicitis.
17	9,600	0	0	0	0	2	52	46	0	Angina pectoris.
18	10,000	0	0	0	1	3	62	31	3	Renal calculus.
19	12,600	0	0	4	0	7	70	19	0	Acute appendicitis, preoperative.
20	11,900	0	0	1	2	12	62	15	8	Fracture, neck of femur
21	13,800	3	0	0	2	14	57	24	0	Pelvic infection.
22	10,400	0	3	1	3	5	49	33	6	Nephritis, acute.
23	7,400	0	0	1	0	3	52	43	1	Goiter.
24	8,200	0	5	0	0	4	59	32	0	Focal infection.
25	6,800	0	3	0	1	7	61	28	0	Gastric ulcer.
26	22,200	0	1	4	5	9	52	28	1	Mastoid, preoperative. Baby.
27	9,800	0	2	1	4	4	48	40	1	Cystitis, acute.
28	14,400	0	1	0	0	5	75	19	0	Salpingitis, chronic.
29	9,600	1	2	4	1	8	45	38	1	Mastoiditis, acute.
30	11,800	0	4	0	0	2	47	45	2	Bronchitis, chronic.
31	18,000	0	0	2	1	10	42	45	0	Mastoiditis, postoperative.
32	16,800	1	1	0	2	6	31	59	0	Mastoiditis, acute.
33	21,000	0	1	0	0	23	58	18	0	Acute appendicitis.
34	8,400	0	1	3	1	7	45	43	0	Cardiac decompensation with edema.
35	17,600	0	0	1	0	14	70	15	0	Carcinoma of bowel.
36	15,400	0	0	0	1	11	72	16	0	Appendicitis, acute, preoperative.
37	17,200	0	0	2	3	12	34	49	0	Mastoiditis, acute.
38	11,200	0	1	1	0	17	53	28	0	Pleurisy, acute.
39	13,600	0	2	1	1	3	40	52	1	Mastoiditis.
40	15,600	0	0	1	0	14	65	20	0	Empyema.
41	13,200	0	0	2	3	17	72	5	1	Probable carcinoma of colon.
42	17,200	0	0	0	1	30	63	6	0	Acute cholecystitis.
43	7,600	0	1	0	0	8	58	33	0	Nephritis, hypertension.
44	14,000	0	0	0	1	19	45	33	2	Postoperative pneumonia.
45	11,200	0	0	0	1	3	69	27	0	Mastoiditis, preoperative.
46	24,000	0	1	2	0	15	62	20	0	Pneumonia.
47	12,800	0	0	2	1	11	71	11	4	Carcinoma of sigmoid.
48	4,200	0	0	1	0	1	32	65	1	Goiter.
49	13,400	1	4	1	0	7	56	24	7	Postoperative pneumonia.
50	6,000	1	1	2	1	6	55	32	2	Probable carcinoma of colon.
51	34,200	0	0	3	6	17	62	10	2	Carcinoma of pancreas, with obstruction of common duct.
52	3,800	0	0	1	0	3	50	45	1	Pernicious anemia.
53	16,900	0	0	2	24	36	35	3	0	Staphylococcus septicemia, abscess of right shoulder.

During the last three months Schilling's formula has been used routinely on all differential counts. The counts shown on page 405 represent a variety of conditions.

Immature forms are found in the peripheral blood, when a responsive bone-marrow is stimulated. This may be caused by a demand to restore blood after a hemorrhage, or may be caused by a toxic stimulation of infection. The deviation to the left in malignancy is usually evident, apparently due to some unknown stimulation. Pernicious anemia (Case No. 52) shows an extreme deviation to right, thereby indicating an unresponsive bone-marrow.

SUMMARY

Schilling's modification of the Arneth count has been found valuable in differential blood-counting.

I. It trains the interns and the technicians to make good blood-preparations, thereby permitting and encouraging better hematology.

II. Study of the types of the granulocytes yields more information than the total leukocyte count and the conventional differential count. Our findings corroborate the previous observations of others.

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OTITIC BRAIN ABSCESS AND ITS DIAGNOSIS

SUPPURATIVE otitis media and mastoiditis represent two common complications of upper respiratory infections. Because of the close proximity of the inner ear and the adjacent mastoid to the brain and its meninges, suppurative disease of the middle ear and mastoid frequently result in affections of the central nervous system of the gravest significance for the life of the individual. In the discussion of the case I am bringing before you, I wish to stress the characteristics and diagnosis of otitic brain abscess, a condition which, when recognized early and localized accurately, offers, with improved surgical technic, an increasingly favorable prospect of recovery.

Case I.—This man is thirty-two years old, is married, and by occupation a farmer. He was admitted to the University Hospital, December 5, 1927, with an entrance diagnosis of pansinusitis and suppurative otitis media.

His wife stated that during the previous month he had been listless and slept more than usual; that on November 23d he developed an acute pain in his right ear, which was followed by a purulent discharge, continued throbbing pain in the ear and a severe headache over the right frontal region. These symptoms increased in severity until his admission to the hospital.

Examination following admission revealed at once lethargy, mental dulness with sluggishness in response to questions and commands, left facial lagging, weakness of the left arm and leg, absence of the left abdominal reflexes, increased left knee-jerk and ankle-jerk, and a questionable left Babinski. There was definite hypesthesia and hypalgesia on the left side, and a diminished sense of position of the left toes. Examination of

the eye-grounds showed a right choked disk of 3 diopters, and an indistinct left disk with 1 diopter elevation. The visual fields were apparently normal, though the patient's stuporous condition prevented accurate testing. The *x*-rays showed a cloudy right mastoid.

Upon the history and neurologic findings a diagnosis of right temporal lobe abscess was made and immediate operation advised. The patient was operated the same day by Dr. W. P. Wherry, attending aurist, and Dr. J. J. Keegan, attending neurologic surgeon. Following the mastoidectomy, the cranial cavity was entered and pus evacuated from the right temporal lobe. His condition improved at once, but about two weeks later he again became apathetic, complained of headache, vomited, showed a slow pulse, increased left-sided hypesthesia and motor weakness. Craniotomy was again performed December 28th and a large abscess cavity located anterior to the former one. Improvement was prompt and the patient progressed steadily to recovery. He was discharged well, January 15, 1928.

This case presents typical features of a right temporal abscess with favorable course following prompt surgical relief. The positive diagnostic features to be noted are: the history of middle-ear suppuration, onset of severe headache, mental sluggishness, homolateral choked disk, left facial weakness, absence of left abdominal reflex, diminished postural sense in the left great toe, and a left questionable Babinski.

The report of two other recent cases of temporal lobe abscess complicating otitis media are of interest in this connection.

Case II.—Max T., aged nine, was seen April 28, 1927, in consultation with Dr. Lloyd Myers of Shelby, Nebraska. A history was given of scarlet fever in the fall of 1926, in which a right otitis media developed and in which a mastoidectomy was performed in February, 1927, with apparently good recovery. Early in April, he complained of severe headache on the right side, vomited and had a temperature of 103° to 104° F. A lumbar puncture performed then revealed a high pressure, 30 to 40 cells, mainly lymphocytes. There was considerable relief

following the pressure. A week prior to examination he had developed diplopia and stupor. Two days before, he complained of extreme headache with repeated vomiting. Lumbar puncture was repeated, showing clear fluid and *no pressure*. He was very restless following the puncture. The next morning he was found to have a right hemiplegia associated with clonic movements of the left side, and he was very comatose. When examined that evening he was in coma with a pulse of 60, temperature 100° F., right pupil dilated, neck rigid, double choked disks, 3 to 4 diopters elevation, right hemiplegia, and an ankle-clonus and positive Babinski on both sides. A diagnosis of probable right temporal lobe abscess with herniation of medulla in the foramen magnum was made, and immediate operation recommended. He was operated the next morning by Dr. J. B. Potts, who reopened the old mastoid wound, removed granulations and, extending the bony resection upward, found pus upon puncture of the temporal lobe. Approximately 3 ounces of pus were evacuated. The patient after recovery from surgical shock was mentally clear, was relieved of his hemiplegia, and showed objectively only a right sixth nerve palsy and a left homonymous hemianopia. His recovery was uneventful, and he left the hospital May 13, 1927, with practically normal visual fields and without diplopia.

The interesting feature of this case is the confusing clinical picture induced by the second lumbar puncture. The presence of the rigid neck, marked vomiting, pronounced choked disks, double ankle-clonus and Babinski suggested the possibility of a subtentorial abscess, but the dilated right pupil, indicating increased volume of the right cerebral hemisphere and pressure on the third nerve, and the sudden development of the hemiplegia and rigid neck following the lumbar puncture pointed rather to medullary compression secondary to the puncture. It is also quite likely that, had the abscess been cerebellar, death would have followed the second lumbar puncture.

It is probable that examination of the visual fields prior to the occurrence of coma would have shown a left hemianopia, a valuable objective sign in right temporal lobe abscesses where

aphasic symptoms do not, as in left temporal lobe localizations, aid in the discrimination between temporal and cerebellar abscess.

Case III.—The other case was that of a man of nineteen, seen in consultation with Dr. W. F. Callfas, who had entered the Methodist Hospital October 5, 1926, for the treatment of an exacerbation of a left-sided otitis media of two years duration. He had complained of dizziness and headache for five days, had vomited and had shown a mild stupor. Upon examination there was found mental dulness, pain in the left temporal region, normal eye-grounds and visual fields, and negative objective motor, sensory, and reflex findings. There was present, however, an anomia, an aphasic syndrome, which was discovered when tests were made for astereognosis. Objects such as a pin, dollar, and handkerchief could not be named, though recognized. When questioned, he would say, "I know what they are, but I can't name them." His temperature was 98° F., pulse 60 to 68, respiration 20, leukocytes 10,500, polymorphonuclears 80 per cent., lymphocytes 20 per cent. A diagnosis of posterior temporal lobe abscess was confirmed by operation and an uneventful recovery followed.

The clinical importance of this case lies in the fact that, while a diagnosis of probable brain abscess could have been made from the general signs of mild stupor, headache, slow pulse and vomiting, there were no localizing signs other than the aphasia. It is worth noticing also that the aphasia was not apparent upon casual observation as he responded readily to questions when roused. It was only when he was asked specifically to name objects that the aphasic defect became apparent.

While otitic brain abscess may very occasionally be found at a distance from the infected ear, for instance, in the frontal lobe, a very great majority are located either in the temporal lobe or in the cerebellum. Oppenheim cites statistics which give a ratio between temporal lobe and cerebellar localizations of three to one. The following cases are quite typical of cerebellar abscess.

Case IV.—Mary P., aged ten, seen in consultation with Dr. W. F. Callfas of Omaha, March 24, 1927. There was a history of influenza three weeks previously, with an onset of purulent discharge from the left ear three days later. Shortly after, severe frontal headache and vomiting. On examination the patient was alert and responsive, complained of severe headache aggravated by movement of head; nausea and vomiting marked; visual fields normal; papilledema, right 2 diopters, left 1 diopter; no nystagmus; no vertigo; fifth and seventh nerves normal; neck rigidity absent; right-sided adiodokokinesis present; moderate ataxia present in right arm and leg; no alteration of power or sensation; reflexes normal.

Diagnosis, right cerebellar abscess.

Operation: Mastoidectomy, uncovering, at the same time, the dura posterior to the lateral sinus. Drainage of the abscess was carried out next day through a dural opening posterior to the sinus. Recovery was uneventful.

Case V.—John H., aged twelve, had a history of chronic ear discharge with a mastoidectomy a few weeks previous to his last hospitalization, which occurred June 20, 1927, following an exacerbation of head pains, nausea and vomiting. The mastoid wound was reopened and mastoid granulations were removed. No improvement. Seen July 5, 1927, in consultation with Dr. J. B. Potts, the patient was found very weak, but with clear sensorium; complained of severe headache; temperature 98° F., pulse 52; retinal vessels dilated, no papilledema; visual fields normal; horizontal and vertical nystagmus present; right lateral deviation poorly carried out; hypalgesia of the right face; right facial weakness of peripheral type; hand grips equal; adiadokokinesis, present on right side, absent on left; ataxia with right heel-knee test; sensation normal, upper and lower limbs; reflexes all normal.

With this history and symptoms as related, a diagnosis of abscess of the right cerebellar hemisphere was clearly indicated. Operation revealed an abscess cavity upon exploratory puncture of the cerebellum, below and posterior to the knee of the lateral

sinus. Death occurred suddenly on the fifth day with signs of respiratory failure.

An autopsy showed a single abscess cavity in the right cerebellum, apparently well drained. No meningitis. Death was probably due to edema and medullary compression.

The following history illustrates the possibility of confusion between brain-abscess and tumor.

Case VI.—Olga S., aged twenty-five, had suffered from a right-sided headache for three and one-half months; her left ear had discharged since the age of eight; a mastoid operation was performed two and one-half months prior to my examination; influenza six weeks later, with recurrent headache, vomiting, and slight fever since. When examined she was found in a comatose condition; there were present papilledema of from 1 to 2 diopters elevation, right more than left; vertical and lateral nystagmus; weakness, left sixth nerve; right facial weakness of cortical type; awkwardness and ataxia of right hand; all sensory findings normal; knee-jerks absent; ankle-jerks, right present, left absent; Babinski negative, right and left; pulse 70 to 80; temperature 98° F., respiration 26.

Precise examination was impossible owing to the degree of coma but a diagnosis of cerebellar abscess, presumably left-sided, was made, based upon the history of left otitis media, mastoidectomy, nystagmus, ataxia, and sixth nerve weakness. The comatose condition was attributed to an internal hydrocephalus, due to blocking of the cerebrospinal fluid circulation by displacement of the cerebellar mass.

A bilateral suboccipital decompressive operation was carried out with exposure of both hemispheres. Puncture on both sides failed to reveal an abscess. Following the operation the patient's sensorium became clear, and her headache improved. After a varying course she was dismissed two months later, improved, but showing a tremor of the left arm, nystagmus, dysarthria, occasional headache, and a double optic neuritis of 1 diopter elevation.

Two and a half months later she was readmitted to the

hospital with her condition much worse. She presented bulging of the left occipital region, a clear sensorium, nystagmus, dysarthria, waving tremor of the right arm, ataxia marked on finger nose test, power of hand grips fair and equal, sensation normal; abdominal reflexes, right absent, left present; power of limbs fair and equal, ataxia present equally on both sides, sensation normal, knee-jerks and ankle-jerks all present; Babinski absent, right and left; clonus absent, papilledema of both disks of 3 to 4 diopters, temperature 98° F., pulse 84, respiration 18.

The impression received in view of the previous negative cerebellar puncture was that of a cerebellar glioma. Operation was thought inadvisable. Death occurred six weeks later. An autopsy showed an abscess of the left cerebellar hemisphere.

In this case the localization of the lesion was recognized as cerebellar. There was some doubt as to which side was involved owing to the predominance of the ataxia on the right side. The nature of the horizontal nystagmus in this case was of no localizing value as it is in so many cases of unilateral cerebellar lesion where deviation of the eyes to the side of the lesion causes a slow, coarse nystagmus, while deviation to the healthy side produces a rapid rhythmic movement of the normal physiologic type. It was felt that the right facial weakness of cortical type, together with the absence of the right abdominal reflex indicated a pressure upon the pyramidal tract above the decussation and was, therefore, a further evidence of a left-sided lesion.

Our failure to operate a second time or at least to puncture the bulging left cerebellar hemisphere through the decompression aperture, because of the former failure to find abscess at the previous operation, was an error of judgment. The case serves as a lesson that clinical indications should be followed even though former operative procedures apparently discount clinical deductions.

According to statistics quoted by Oppenheim and Lewandowsky, otitic brain abscesses represent about one-half of the total number of brain abscesses. The ratio of incidence of brain abscess in acute and chronic suppurative ear disease is as 1 to 4 (Heimann).

The diagnosis of otitic brain abscess is based upon the history of an ear infection and upon general and local symptoms.

Symptoms.—The general symptoms, in order of importance, are headache, vomiting, disturbances of consciousness, slow pulse, optic neuritis, fever and convulsions.

Headache is one of the earliest symptoms marking the onset of intracranial complications. It is often unilateral on the side of the lesion. It may vary greatly in intensity, but is rarely absent. It may be associated with local tenderness of the temporal or occipital regions.

Vomiting in the course of a middle-ear infection is a sign of the gravest significance in the absence of labyrinthine disease. In temporosphenoidal abscess it may be infrequent and even absent, but in cerebellar abscess it is often very persistent and troublesome. It is to be recognized that it may mark the onset of an acute general septic meningitis, of a localized extradural or intrameningeal abscess, or of a non-suppurative meningitis or serous meningitis.

Clouding of consciousness, mental hebetude, apathy, and stupor are states significant of cerebral abscess as opposed to a cerebellar localization, but as in the third case of cerebellar abscess described, marked stupor may develop from a secondary internal hydrocephalus. In temporal lobe abscesses "dreamy states" are not uncommon.

Slow pulse is a common sign of increased intracranial pressure. It is not always present or it is only present intermittently. For this reason, frequent pulse records should be made in suspected cases. When present it is a sign of great importance.

Optic neuritis and papilledema are said by most authorities to be far less frequent than in cases of brain tumor. It has been my experience to see papilledema in at least 60 per cent. of my cases. Oppenheim quotes Ohada as noting nerve head changes in two-thirds of a series of 46 cases.

Fever is a symptom of uncertain frequency. Its presence accompanying symptoms of cerebral compression is significant of brain abscess. As a rule, the rise of temperature is slight, rarely exceeding 101° F., and averaging 99° to 100° F. The

leukocyte count in an uncomplicated brain abscess subsequent to the initial stage of localization in the brain is rarely high, frequently not exceeding 10,000.

Convulsions in otitic brain abscess are also rare. When present they are valuable signs of cerebral involvement.

When the above general symptoms, or at least the first three, are present, together with a history of suppurative ear disease, the diagnosis of brain abscess is justified and immediate surgical intervention is imperative. The next step is that of localization.

In an anatomical sense the localization depends on the pathway of the septic invasion. Disease of the tegmen and of the upper cells of the mastoid tend to localize the abscess in the temporal lobe. Septic processes, invading the labyrinth or the perilabyrinthine bony cells or the lower cells of the mastoid, determine a cerebellar localization. In both instances, the march of the infection into the subcortical tissue takes place through a local meningitis or through a retrograde thrombophlebitis or perivasculitis.

Clinically, the differentiation between temporal and cerebellar abscess is generally easy though, at times, all signs seem to fail and diagnosis is extremely difficult.

A general rule applicable to tumor is of service here. Cerebral abscess or tumor causes early mental symptoms and late cranial nerve signs; cerebellar abscess or tumor results in early and pronounced cranial nerve symptoms and late mental involvement.

Temporal lobe abscess is marked by mental symptoms such as sluggishness or torpor, dreamy states and, in left-sided cases, by some aphasic syndrome of the sensory type.

Hemianopia when present is a conclusive sign of temporal lobe abscess. Contralateral facial weakness of cortical type, either alone or accompanied with motor or sensory loss of the arm and leg, is further evidence.

Dilation of the homolateral pupil, and weakness of the external rectus as in Case II, are to be watched for as indicating compression of the third and sixth nerves at the base.

Cerebellar abscess reveals its presence through symptoms either of labyrinthine or of cerebellar dysfunction.

The labyrinthine or vestibular symptoms are vertigo, nystagmus, past-pointing, and falling. These symptoms may be present in peripheral labyrinthine disease, and are to be differentiated then from the same symptoms due to central disease.

Bárány, in his studies of labyrinthine function has distinguished between purely labyrinthine symptoms and those due to lesions of the central vestibular connections in the brain-stem. The presence of a coarse irregular nystagmus is always central; a persistent vertical nystagmus is generally central; spontaneous nystagmus that persists and does not rapidly improve is also central in origin. Vertigo and a tendency to fall, which is progressive, is central, in contradistinction to the vertigo and forced movements of an acute labyrinthine disease which are of transitory nature. Eggleston, in his work Brain Abscess is inclined to stress the unreliability of past-pointing and falling symptoms as of diagnostic value in brain abscess. He emphasizes the loss of reactability on the part of the vertical canals to the caloric test as an early diagnostic sign of increased intracranial pressure, and so of marked value in the early diagnosis of cerebellar abscess. In cases of brain abscess lateral deviation of the eyes, due to unopposed vestibular pull, is indicative of cerebellar abscess.

The most frequent signs of cerebellar asynergia, due to brain abscess, are homolateral adiadokokinesis, and ataxia of the cerebellar type shown in the finger-nose and heel-knee tests. The ataxia is unchanged whether the eyes are open or shut. Where there is pronounced cerebellar displacement the ataxia may be bilateral. The gait of the cerebellar ataxic patient is carried out with legs wide apart, and is of the drunken type. While the patient may tend to deviate to the side of the abscess, compensatory mechanisms may produce swaying to the opposite side.

Accompanying symptoms may point to involvement of the contents of the posterior fossa. Peripheral facial weakness, hypesthesia of fifth nerve distribution with loss of the corneal

reflex, dysarthria due to asynergia of the articulatory movements, when present singly or in combination, are of great help in the diagnosis of cerebellar localization.

A rigid neck is often a sign of severe subtentorial or posterior fossa pressure, and then does not indicate meningitis.

Differential Diagnosis.—In the presence of signs of intracranial involvement accompanying an acute or chronic purulent otitis media, we should keep in mind the possibility of confusion between brain abscess and labyrinthitis, septic meningitis, extradural abscess, and serous meningitis.

I have already discussed the difference between the symptoms due to labyrinth disease and those due to lesions of the central vestibular mechanisms in cerebellar abscess. I will only reemphasize the fact that a coarse, arhythmic nystagmus or a marked vertical or diagonal nystagmus would indicate abscess and not labyrinthitis.

A general septic meningitis is, as a rule, distinguished by the high fever, rapid pulse, delirium, rigid neck associated with motor unrest, Kernig sign, its acute onset and rapidly progressing course, and finally by lumbar puncture, showing a purulent fluid and micro-organisms. It is my impression, based upon observation, that it is possible to have, in association with septic infection of the paranasal sinuses or the mastoid, a cloudy fluid of moderate degree with polynuclear cells and even with bacteria which clears up upon drainage of the original source of infection. It is doubtless a matter of virulence and individual resistance.

Having in mind several fatal cases of acute septic meningitis, developing within a very few weeks after the onset of the ear infection and during local or conservative treatment, the advisability of early mastoidectomy has been very forcibly impressed upon me. The danger lies in delay.

Extradural abscess complicating mastoiditis may at times produce signs suggestive of brain abscess. There may be slow pulse, torpor, vomiting and severe headache but, as a rule, localizing symptoms are not in evidence, and the abscess is discovered in the course of the mastoidectomy.

Lateral sinus thrombosis with its severe chills, high remitting fever, its sweats, positive blood-cultures, is hardly to be considered as a neurologic complication and is mentioned here only because at times cerebral symptoms suggestive of abscess may be present, which subside following successful ligation of the jugular vein and opening of the sinus.

The most interesting and yet deceptive complication of septic otitis media, exclusive of brain abscess, is serous meningitis. Serous meningitis or aseptic non-purulent arachnoiditis is a condition that may develop in the course of various infectious diseases such as whooping-cough, measles, influenza, after trauma and even in association with dental focal infection, as in two cases that I have observed. It is to be found also in connection with paranasal sinusitis, and often as a result of septic otitis media and mastoiditis. It may vary in intensity from mild forms in which the only symptoms may be moderate headache, a slight neck rigidity and a sixth nerve palsy as in Gradenigo's syndrome, to a condition marked by severe headache, stupor, choked disks, and objective signs indicating either temporal lobe or cerebellar abscess. The pleasing feature about this disease is that the symptoms disappear following removal of the septic focus, or following repeated lumbar punctures.

A recent case referred to me by Dr. E. H. Dwyer of Gordon, Nebraska, illustrates a more severe type and the happy result which follows surgical treatment.

Katherine H., aged eleven, seen first on March 31, 1927. There was a history of a recurrent discharging ear since the age of three. A month previously there was a renewed discharge, followed by right temporal and supraorbital pain, diplopia, and headache. Vomiting occurred at times. There was a gradual development of weakness in the left leg; pain in the mid-dorsal region, and difficulty in starting urination. The child was dull and looked very ill.

Examination revealed temperature 99° F., pulse 120, respiration 20; a right sixth nerve palsy; photophobia of the right eye; bilateral papilledema of 3 diopters; tenderness over the right anterior temporal region; moderate neck rigidity; visual

fields normal; partial deafness, right; the other cranial nerves normal.

The upper extremities were normal in all respects. Hoffman reflex absent. The left abdominal reflexes were markedly diminished. Both lower extremities were weak, the left more than the right; knee-jerks and ankle-jerks were absent on both sides.

Babinski sign absent, right and left. The Kernig sign was negative, and ataxia was absent. Sensation was normal in all forms.

A preoperative diagnosis of right temporal lobe abscess was made. The possibility of a serous meningitis was considered because of the loss of both knee-jerks and ankle-jerks, a symptom that I have found repeatedly in cases of serous meningitis where the high intracranial pressure has been conducted hydrostatically to the lumbar dural sac, apparently blocking the tendon reflexes by continued pressure upon the motor roots at their point of exit from the dural sac.

A radical mastoidectomy was performed by Dr. J. B. Potts, and the temporal lobe was explored by puncture. No abscess was found. Steady improvement followed the operation, and the patient was out of bed on the ninth day. By April 23d the patient was up and about, feeling well. There was no headache, no temporal tenderness, the left disk was flat, the right still showed some blurring. The external rectus palsy had disappeared, the abdominal reflexes were prompt and equal on both sides, and the knee- and ankle-jerks were also prompt and equal. The patient was dismissed April 25th with a final diagnosis of serous meningitis secondary to chronic mastoid. A letter from the father nine months later reported the child active and well.

Another case suggesting a localized posterior fossa arachnoiditis, was that of a woman, a patient of Dr. J. B. Potts, who, following two mastoid operations on the left ear, complained of numbness of the left side of the face and tongue, nausea, continued retching and vertigo. There was no other evidence of cerebellar dysfunction. There was definite hypesthesia and

hypalgesia in the distribution of the left fifth nerve. The eyegrounds were normal. Temperature 98.8° F., pulse 84, respiration 20. Lumbar puncture showed a pressure of 6 mm., a clear fluid, and no cells. A cerebellar abscess or a localized meningitis of the left pontocerebellar angle region were thought probable and exploration was advised through the mastoid wound.

When the dura was nicked posterior to the knee of the lateral sinus, a spurt of straw-colored fluid occurred, which was followed shortly by clear fluid. Relief of the vomiting followed at once, and the fifth nerve hypesthesia disappeared in a week.

This case is still under observation as the patient, a woman, of twenty-five, later developed a left-sided functional hemianesthesia and analgesia, together with diffuse pains over the left side of the head. The hemianesthesia was cured by a single electric treatment, but other functional symptoms remain. While the possibility of further organic disease is recognized, the development of similar functional symptoms is mentioned by Oppenheim as occurring in patients constitutionally predisposed to psychogenic disorders, and as requiring consideration in the differential diagnosis of otitic brain abscess.[1]

Treatment.—The treatment of brain abscess is entirely surgical. Two fundamentally important facts may legitimately be stressed by the neurologist. First, that an acute or chronic suppurative otitis media is always a serious menace to life, owing to the danger of septic meningitis, lateral sinus thrombosis or brain abscess; second that, in the case of brain abscess, early diagnosis, accurate localization, and early operation are the main sources of a low mortality rate.

Prognosis.—The prognosis of brain abscess is always grave. Statistics vary from a recovery rate of 10 per cent. to a record by Macewen of 18 recoveries out of 19 cases. Eagleton gives

[1] This patient later developed a typical hysterical stupor with which were associated terrifying hallucinations. This condition lasted ten days and was followed by amnesia for the episode. Hypnosis revealed an adequate psychogenic cause for the hysterical symptoms. Recovery followed.

a record of 25 per cent. recoveries, though he states that his results have been better of late with improved technic. Oppenheim and Cassirer collected reports of 206 cases with a recovery rate of 70 per cent. in the temporal lobe cases, and of 45 per cent. in the cerebellar localizations. The mortality rate of cerebellar abscess is uniformly higher than that of cerebral abscess.

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OCULAR COMPLICATIONS OF DIABETES

THE ocular complication of diabetes whose occurrence is best known is undoubtedly cataract. On the whole the importance of cataract in diabetes is probably overestimated rather than the contrary. For while a cataract observed in a diabetic is often considered a diabetic cataract, this is by no means always the case. The incidence of cataract in diabetic patients has been variously estimated. Schmidt-Rimpler found it in 45 per cent. of cases, Galezowski in 31 per cent., Kako in 30 per cent., Lagrange in 25 per cent., Gradle in 53.71 per cent., and Anderson in 16 per cent. The variation depends on what degree of opacity in the lens was considered a cataract, and whether or not the pupils were dilated for examination. Gradle, for instance, examined all his cases with the slit lamp and under a mydriatic. When we compare with these figures the incidence of cataract in any large series of non-diabetic patients at ages above forty, it is seen that the differences are slight. Gradle, for example, found that between the ages of forty-one and fifty, 34.1 per cent. of lens opacities were seen, and between sixty-one and seventy, 68.4 per cent. Barthe found that 96 per cent. of all persons over sixty had some form of lens opacity which could be seen with the slit lamp. Anderson, comparing 292 diabetics with 900 non-diabetics, found a slight difference in favor of the diabetics in only one age group, fifty-one to sixty; while between sixty and eighty, cataract was more frequent among non-diabetics. In most diabetics over forty, the cataract is indistinguishable clinically from ordinary senile cataract. Thus, considering the large number of cases of diabetes in patients over forty, we

must expect a certain number of cataracts to occur, and will hardly call a cataract a true diabetic cataract unless it conforms to the type occasionally seen in younger diabetics, in whom cataract from natural causes is rare. In the ordinary case of cataract occurring in a diabetic, the problem is purely one of treatment; the decision when to operate and what measures of pre- and post-operative care are necessary which would not be called for in operation upon a non-diabetic patient. While in the preaseptic days the well-known lowered resistance of diabetics to infection made some operators refuse to operate on them, with modern aseptic technic and ordinary care to free the conjunctival sac from infectious organisms, the operation is attended with very little more risk than in a non-diabetic. Still, most operators prefer to have their patients made sugar-free if possible, or at least to have the amount of sugar reduced to an amount not over 1 per cent. With the use of insulin, this requires less time than formerly, but the patient should be given enough insulin after the operation to maintain control of the condition.

Where the above care has been given, the outcome of operation has, in my experience, been favorable. There is a little more tendency to inflammation when, as often occurs, cortex is left within the eye. Also, one may be disappointed in the result of an uneventful cataract operation on a diabetic, by reason of central retinitis which could not be diagnosed before removal of the cataract. Mrs. M., aged fifty-six, showed 1 per cent. of sugar and this was reduced to a trace before operation, by diet. After the operation it rose to 1.2 per cent., but disappeared in three days. After a smooth extraction and uneventful postoperative recovery, vision could only be brought up to 8/200, and opthalmoscopic examination revealed the presence of a large area of white exudate in the macular region, with several fresh hemorrhages around it. I have seen one postoperative hemorrhage, but have not seen an eye lost by purulent infection after cataract operation in a diabetic. Neither have I seen acidosis or any other serious complication in the general condition of a diabetic as the result of a cataract operation.

What may be called true diabetic cataract is characterized by the appearance of fluid vacuoles under the capsules of both lenses, which progresses rapidly to complete opacity in periods of a few weeks to six months. This may occur at any age, from that of eleven months, as reported by Major and Curran. Gradle saw a course in three of his patients, all over fifty, which suggested that they were true diabetic cataracts. In his cases, and in others reported, the blood-sugar was no higher than in many cases which did not develop cataract, being less than 200 mg. in 2 cases, so that it is evidently not simply the presence of sugar in the blood and intra-ocular fluids which causes the cataract. Schnyder, who examined 59 diabetics with the slit lamp, found one one case which he considered to show true cataracts. This was a woman of thirty-three, with severe diabetes, who developed during five months numerous vacuoles and water fissures under the anterior and posterior capsules, the picture of which, as seen with the slit lamp, he considered characteristic of diabetic cataract.

A condition which is allied to diabetic cataract, and which throws some light on its pathogenesis, is the occurrence of remarkable changes in refraction during the course of diabetes. Duke-Elder has described 3 such cases, in which the changes in blood-sugar were recorded at the time of the refractive changes. One case, with a very high blood-sugar, developed myopia of over 13 diopters in each eye shortly before death. Two other cases developed hyperopia of over 5 diopters when the blood-sugar was brought down from a high to a low level under treatment. When the sugar was allowed to go up, the hyperopia almost disappeared, to reappear again when treatment was renewed and remain until some time after a normal blood-sugar had been established. Schnyder reports 1 case of myopia developing in his series, and Duke-Elder found 45 cases of refractive changes reported in the literature. He explains them as due to disturbances in the content of the blood caused by the changes in blood-sugar. When this becomes suddenly high, the osmotic pressure of the blood becomes low through the pouring of fluid into the blood from the tissues, and the loss of sodium chlorid

from the blood. This fluid of low osmotic pressure is able to penetrate the lens capsule, causing the lens to swell, with resulting myopia. If enough fluid collects in the lens, permanent changes in the form of cataract develop. If the blood-sugar is lowered before this occurs, the lens gives up water and becomes flatter than normal, with resulting hyperopia. I have seen two cases of increased hyperopia in diabetes, one of which had been refracted a year before, so that an actual increase of 2 diopters in the hyperopia of each eye could be demonstrated. These cases were seen in office practice and blood-sugar findings were not available, but both were being treated, and presumably the blood-sugar had been reduced.

Changes in the intra-ocular tension occasionally occur in diabetes. A few cases of glaucoma occur, usually as the result of a vascular lesion and accompanied by hemorrhages. In severe cases, with high blood-sugar and acidosis, hypotony is the rule, the globes becoming very soft in the terminal stages. This is probably due to loss of fluid from the aqueous and vitreous in an attempt to dilute the hypertonic blood.

Much more important than any of the changes that have been described are the retinal changes, the retinitis of diabetes. This occurs in over 20 per cent. of diabetics (Schmidt-Rimpler 23 per cent., Galezowski 21 per cent., Kako 23.5 per cent., Lagrange 36.5 per cent., Gradle 21.96 per cent., Anderson 52 per cent., Schnyder 28 per cent.). It is important because it seriously interferes with vision in some cases, and because, naturally, it is not amenable to surgical treatment.

Two types of lesion are seen, often together; white patches which are usually small and single or in small groups, not tending to become confluent in large masses like the white spots of albuminuric retinitis, and hemorrhages. The white spots are seldom arranged in a star-figure around the macula, as in albuminuric retinitis, but are frequently seen in the central region, and around the nerve.

The hemorrhages are found in all parts of the retina, but are most frequent along the large vessels not far from the nerve. Occasionally hemorrhages into the vitreous occur, producing the

picture of retinitis proliferans, and there seems to be more tendency for this to occur than in the hemorrhages of nephritic or arteriosclerotic origin. Nearly always both hemorrhages and patches of exudate are seen in the same eye. The extent to which vision is interfered with depends on whether or not the central area is involved. In an ophthalmologic practice, it is usual for this area to be involved in one or both eyes, as the patients only come in for observation when this occurs. Thus in a series of 15 office cases, vision was 20/50 and 20/100, 20/200 and 20/20, 3/200 and 1/200, 20/200 and 20/50, 20/100 and 6/200, 20/70 and 20/30, 20/100 and 20/100, 20/70 and 8/200, 20/100 and 20/200, 8/200 and 20/50, 20/70 and 20/30, 20/200 and 6/200, 20/30 and 7/200, counting fingers and 2/200, 20/40 and 20/200. Thus, all but two were able to get about fairly well, while five were unable to read, and two were rendered practically helpless from poor sight. Most of these patients had known of their diabetes for four to twelve years, and the retinitis must, in most cases, have existed for a considerable time before examination.

The question of the relation between diabetic retinitis and the frequent renal complications of diabetes is an interesting one. Wagener and Wilder, in 1920, reported on 44 cases of diabetic retinitis seen among 300 diabetics at the Mayo Clinic. Retinitis was not seen in the severe forms of pure diabetes, but always in mild, easily controlled cases, with some evidence of vascular disease. They describe a type of retinitis characterized by superficial flame-shaped hemorrhages which was seen in 9 cases with more severe vascular and renal complications. They believe so-called diabetic retinitis is due to arteriosclerosis, but modified by the presence of diabetes to a form which is distinguishable ophthalmoscopically from ordinary arteriosclerotic retinitis. Complete kidney functional tests were not made in most of these cases, the blood-pressure was over 150 in only 11, and the authors do not state on what they based their opinion that all had vascular disease. Since this report, American ophthalmologists may have been inclined even to doubt the existence of pure diabetic retinitis, and in France,

Beauvieu and Pesme came to much the same conclusion. A recent report by Lo Russo, however, on careful examination of 26 cases of diabetic retinitis, does not agree with these findings. He found 9 cases with changes in renal function and in the cardio-vascular system, 5 with hypertension, 5 with increased total nitrogen, but normal Ambard's constant, and 5 without any complication of the diabetes, and hence cases of pure diabetic retinitis. My series of office cases does not throw much light on this point, as only tests for urinary sugar and albumin were made in the office, and findings on other tests of renal function which were made by their family physicians away from Omaha are not in most cases accessible.

A typical case of diabetes complicated by interstitial nephritis is that of Mrs. K., aged sixty-four. Her vision when first seen was right 20/30, left 20/70. Masses of white, fluffy exudate, with some fresh hemorrhages were seen in the central areas of both retinæ, and in the left eye, several small retinal veins were occluded. Six months later, during which time she had been on systematic treatment, including the use of insulin, vision was reduced to right 20/40, left 20/100, the fundus picture remaining about the same. After another year of rather intermittent treatment, vision was right 20/100 and left 20/200, and there were new masses of exudate in the macular regions, with a blurring of the nerve borders, a picture not unlike the neuroretinitis of albuminuric retinitis. At this time the urine was loaded with sugar, and tested 1+ for albumin. Systolic blood-pressure was 220. Another case, illustrating what may happen in cases complicated by hypertension, is that of Mrs. B., aged sixty-four, who has a systolic blood-pressure of 200 and urine negative for albumin. She came in with a thrombosis of several small branches of the central retinal vein in the left eye, and vision reduced to 7/200 in this eye. After three months of treatment, including insulin, some of these vessels became patent, the hemorrhages were absorbed, and vision increased to 20/50. After another three months, most of which time she was sugar free, the retinal arteries became very small, and secondary atrophy of the nerve occurred, cutting down the

visual field and reducing the vision to 7/200. In the other eye, which showed a typical punctuate central retinitis, vision has remained 20/30, and no vascular lesions have developed.

The rapid loss of vision in these complicated cases is in contrast to the usual course in those without definite renovascular lesions, in which useful or even good vision may be retained for years, as long as thirty years in one of Lo Russo's cases. It is true that most cases occur in patients past the age of fifty, in whom arteriosclerosis cannot be ruled out. Knapp states that retinitis occurs almost exclusively in old age, and Gallus, who examined 76 young soldiers with diabetes, found only one case of retinitis, in a man who had had diabetes for twenty years. All of my cases were over fifty years of age. Grafe, in a series of 80 cases of retinitis among 600 cases of diabetes, found that most showed hypertension, the average blood-pressure being 170. The average life of these patients after retinitis was discovered was seven years, and other authors agree that the prognosis for life, as well as for vision, is much better in these cases than in those of albuminuric retinitis. In a series of 48 cases of diabetic retinitis reported by Nettleship, two-thirds lived more than two years, while two-thirds of his cases of albuminuric retinitis died in one year. In other words, the presence of retinitis in a diabetic does not indicate a particularly grave prognosis, probably no graver than the other signs of diabetes would indicate, while albuminuric retinitis seen in a nephritic points to an expectation of life not longer than two or three years, and often less than a year. This difference in prognosis both as to life and vision is one of the important things to be gained from a careful ophthalmoscopic examination by one who has both conditions well in mind. It must be remembered that the prognosis in arteriosclerotic retinitis, which must be distinguished from albuminuric retinitis, is as favorable as that of diabetic retinitis, and, in my experience, the prognosis for vision is slightly more so. Whether or not we believe with Wagener and Wilder that the retinitis of diabetes is always due to arteriosclerosis, and it must be remembered that there are some cases which show no other signs of vascular disease, it is

true that it occurs nearly always at the age of vascular degeneration, and that its lesions are the result of changes in the permeability of the retinal vessels, similar to those which cause arteriosclerotic retinitis. It has been my experience to see arteriosclerotic retinitis in a fair number of patients showing a normal blood-pressure and no other signs of generalized arteriosclerosis, and since retinitis only occurs in about one-fifth of diabetics, it is possible that it affects only those persons who have abnormal retinal vessels. It must be remembered that the retinal vessels are the only ones which can be observed under such favorable conditions, so that similar changes may be occurring about the vessels in other parts of the body, without giving us any evidence of their presence. Some comparisons between retinal vascular lesions and the condition of the vessels of the nail-bed as seen by capillary microscopy, have been made by Scheerer, and it would be interesting to have such observations in cases of diabetic retinitis.

SUMMARY

1. True diabetic cataract may occur, but is rare, while senile cataract occurring in the diabetic is common and does not differ from cataract in the non-diabetic.

2. With a little preoperative care to reduce the urinary sugar to the minimum, operation in these cases is not attended by any great risk.

3. Cataract, and rapid changes in refraction occurring in diabetes, are probably the result of changes in the osmotic pressure of the blood.

4. Retinitis occurs chiefly in diabetics past the age of fifty, often with renal or vascular complications, but also without any signs of these. It may be the only sign of an abnormal condition of the vessels in these patients.

5. The prognosis for life and vision is relative good in diabetic retinitis in contrast to that in albuminuric retinitis.

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DISTURBANCES IN GROWTH

IN the study of the growth and development of an organism two main phases must be considered, namely, the study of the substances taken into the organism and utilized for tissue production, and the study of the mechanism through which this utilization is accomplished. In other words, we must study food in its manifold aspects, and we must investigate the metabolism and all of the factors which influence it.

A vast amount of work has been done in the study of food in the last few decades. The importance of properly balanced diet, of diets sufficient in calories, in vitamins, and in certain essential amino-acids, has been emphasized continually in all recent works upon nutrition. Notwithstanding all of the productive investigation along this line, there is still a great field for work upon this phase of the subject.

The study of the second division of the subject leads to many apparently diverse subjects such as the chemistry of metabolism, the rôle of light in growth, the physiology and pathology of the glands of internal secretion, the relationship of disease to the metabolism of growth, and the influence of heredity. All of these have been the subjects of intensive investigation, and a great deal of information has resulted.

In presenting these 3 cases I wish to illustrate some interesting types of the second subdivision mentioned. Hastings Gilford, in his Hunterian Lectures of 1914, gives a comprehensive discussion of defects of growth. He divides growth or development defects into three main groups:

First: Cases in which there is defect in nutrition without defect in development. This group includes those of congenital

type, such as prematurity, congenital organic defects, malnutrition, due to intra-uterine disease or toxemia, and cases of acquired type due to poorly balanced diet, poor hygienic surroundings, and to infectious diseases. The characteristic of this group is the loss of weight and nutritional disturbances of various organs, the development of the child being normal or slightly subnormal for age.

Second: Cases in which there are defects of growth without defect in nutrition or development. These are cases of dwarfism. The patient is much smaller than the average, but shows normal nutrition, and the various measurements of the head, chest, abdomen, extremities, and so forth, are proportional to the height and age.

Third: Cases in which there are defects of development, usually with correlated defects in growth. This group includes all cases of infantilism. The characteristic feature is the retention by the individual of the developmental characteristics of an age-period preceding the present age, that is, a patient thirty years of age may show the development of a child of 14, or a child of three or four years may show the development of a baby of six months or one year. This latter group is further divided into:

A. Essential (Ateliosis):
   1. Sexual.
   2. Asexual.

B. Symptomatic:
   1. Toxic.
   2. Correlative.
   3. Deprivational.

The cause of ateliosis is not known. It may be a mutation or reversion of type such as frequently manifests itself in other ways among plants and animals.

The second large group, the symptomatic, interests us more in the discussion of the cases to follow.

The toxic group includes all of those cases in which some definite etiologic toxin of external origin can be proved. Such are toxins from growth of fungi or protozoa in the body, from

syphilis, tuberculosis, malaria, typhoid fever, organisms responsible for chronic diarrheas of infancy, various infectious diseases, and various inorganic substances such as lead, mercury, and so forth.

The correlative group includes all of those in which the infantilism is due to some hormonic defect. This includes cases of thyroid, pituitary, and pancreatic infantilism.

The deprivational group includes those in which there is an insufficiency of food, as a whole, or of certain specific growth substances.

The first 2 cases to be presented belong to the correlative group.

Case I.—J. S., aged eight years.

Family History.—The father and mother are living and well. There are two older children and one younger, all normal.

Past History.—Up until two years of age the patient was apparently normal in every way. At this time she became very irritable. Three weeks after the onset of the irritability she developed an excessive thirst, awakening at frequent intervals during the night and asking for water. The urine also increased markedly in amount. She first came under my observation at that time, and the prominent symptoms were polyuria, polydipsia, anorexia, loss of weight and marked irritability.

Physical Examination.—(Age, two years.) The child is pale and undernourished. The skin is dry, scaly, and somewhat thickened. The hair is moderately coarse and dry. The throat is normal. There is no cervical adenitis.

The costochondral junctions are slightly enlarged. Harrison's groove is present. The lungs are normal. The apex of the heart is in the sixth interspace, about 1.5 cm. to the right of the nipple line. There is a systolic murmur heard best at the apex, and transmitted throughout the precordium. There is no arhythmia and no accentuation of tones.

The abdomen is not distended. The liver is 3 cm. below the costal margin. The spleen is not palpable. There are no masses and there is no tenderness.

No abnormalities of the reflexes are noted.

Laboratory Findings.—The red blood-cell count is 6,000,000; the white blood-cell count is 28,000; neutrophiles, 68 per cent.; small lymphocytes, 16 per cent.; large lymphocytes, 12 per cent.; transitionals, 3 per cent.; eosinophiles, 2 per cent.; blood-sugar, 0.07 per cent. The Wassermann test is negative. The urine is straw-colored; reaction, alkaline; specific gravity, 1.001; microscopic, no abnormal elements. The von Pirquet is negative.

The eye-grounds are normal.

The *x*-ray shows the sella turcica to measure 7 mm. anteroposteriorly and 5 mm. horizontally. It is clean-cut and smooth. The anterior and posterior clinoid processes are normal.

The use of the posterior lobe pituitrin hypodermically reduced the output of urine greatly. The effect, however, only lasted a few hours. A diagnosis of diabetes insipidus was made. In this case the outstanding features were the excessive thrist and excessive urination. Very little note was made of any disturbance in growth, although, of course, the underweight of from 3 to 4 pounds was very noticeable. During the next three years the girl went through attacks of chickenpox, pneumonia, and measles without any noticeable effect upon the diabetes insipidus. At six years of age the defect in height became noticeable.

Table 1 shows the patient's height and weight compared with normal height and weight for the age, and also a comparison of the patient's average yearly gain in height and weight with the normal. This shows not only a weight defect, but also a failure of growth in height.

TABLE 1

Age.	Height.		Weight.		Average yearly gain.			
					Height.		Weight.	
	J. S.	Average.	J. S.	Average.	J. S.	Average.	J. S.	Average.
6 years.	39 in.	43 in.	29¾ lb.	41 lb.				
7 "	40 "	45 "	33¾ "	45 "	1 in.	2 in.	4 lb.	4 lb.
8 "	41 "	47 "	35 "	50 "	1 "	2 "	1¼ "	4 "

There are two factors here which may be considered in relationship to the growth disturbance:

1. Diabetes insipidus.
2. Chronic cardiac lesion.

The first condition we will discuss after presenting the next case.

The cardiac lesion is probably of the congenital type. There are no signs of impaired cardiac action such as dyspnea, hepatic enlargement, digestive disorder, edema, cyanosis, anemia, or clubbed fingers. It does not seem probable, on this account, that the cardiac condition can be a very important factor in this particular case. Congenital heart-disease is often associated with nutritional disturbance, but in practically all of such cases there is definite evidence of circulatory impairment.

The second case is similar in its general picture.

Case II.—J. B., aged three years, eight months.

Family History.—The father and mother are living and well. There is one older brother who is normal and somewhat above the average in height and weight. Both father and brother have a very mild ichthyosis.

Past History.—The birth was normal and the baby full term. He was breast-fed for about two months, but did not gain. At this time he was put on a milk formula, but was found sensitive to cow's milk, developing a temperature of 104° to 105° F. each time a small amount of cow's milk was added. It was then necessary to make up a mixture of soy bean, barley water, sugar, and cod-liver oil, and then desensitize to cow's milk by giving minute quantities and gradually increasing. After toleration was established he gained slowly. At sixteen months an excessive thirst and polyuria developed.

Physical Examination.—Age, sixteen months. The boy was bright and good-natured. The skin was dry and had a very fine scale over entire body. The hair was sparse, dry, and moderately coarse.

The head was normal in shape. The anterior fontanel was open, approximately 4 cm. anteroposteriorly, and slightly de-

pressed. The posterior fontanel was closed. There was no craniotabes.

The anterior superficial cervical glands were slightly enlarged on the right side. The thyroid was not enlarged to palpation No enlargement of thymus could be demonstrated by palpation or percussion.

The costochondral junctions were slightly enlarged. The lower ribs flared out more than normal. The lungs and heart were normal.

The abdomen was greatly distended and tympanitic. The liver was palpable about 4 cm., below the costal margin. The spleen was not palpable. There were no masses, and there was no tenderness. The testicles were undescended. There was a definite hypoplasia of the sexual organs. At the present time, three years and eight months, this is still very definite.

The extremities were normal.

Laboratory Findings.—The red blood-cell count was 4,000,000; hemoglobin, 75 per cent.; the white blood-cell count was 10,000; neutrophiles, 40 per cent.; large lymphocytes, 20 per cent.; small lymphocytes, 35 per cent.; transitionals, 5 per cent.; no abnormal cells. The urine was straw-colored and clear. Reaction slightly acid. Specific gravity, 1.001; albumin, negative; sugar, negative; microscopic, no abnormal elements. The Wassermann test was negative.

The *x*-ray examination of chest and hands was negative. The gastro-intestinal tract showed findings suggestive of a colitis. The sella turcica measured 5 mm. vertically by 9 mm. horizontally.

The body measurements and weight were: weight, 14 pounds 6 ounces; height, 25 inches; circumference of chest, $16\frac{1}{4}$ inches; circumference of head, $17\frac{1}{4}$ inches; length of arm, $10\frac{1}{2}$ inches; length of leg, 12 inches (anterior superior spine to sole).

Up to two years of age there were frequent periods of anorexia, when it was almost impossible to get him to take food. At two years of age he was put on a powder of whole pituitary gland substance 2 grain, and thyroid gland 1/10 grain. These were given once a day at first, and then gradually increased to

TABLE 2

Age.	Height.		Weight.		Head.		Chest.	
	J. B.	Average.	J. B.	Average.	J. B.	Average.	J. B.	Average.
16 mo.	25 in.	31.1	14 lb. 6 oz.	24½	17¼ in.	18⅞	16¼ in.	18⅞
18 "	25½ "	32.	14 " 4 "	24⅝				
19 "	26 "	32.4	15 "	25½	17½ "	19⅛	16⅜ "	19⅛
20 "	26 "	32.7	15 "	25¾	17½ "	19⅛	16⅜ "	19⅛
21 "	26 "	33.1	14 "	25¾	17½ "	19¼	16⅜ "	19¼
2 yr.	27⅝ "	34.	17 " 14 "	27⅛	18 "	19⅜	17⅜ "	19⅜
27 mo.	28⅝ "	35.1	19 " 7 "	29	18½ "	19⅝	17¾ "	20
29 "	29½ "	35.7	21 "	29¼	18½ "	19⅝	18½ "	20
32 "	30¼ "	36.	22 " 10 "	30⅝	18⅞ "	19¾	19¼ "	20⅜

three times a day. At the present time he is taking three powders a day. Previous to this he had been given 1/10 grain thyroid extract irregularly. It produced diarrhea when first taken, and so had to be discontinued every few days. Since taking the pituitary and thyroid substances the hair has become softer and finer and the skin less dry. The appetite is excellent. The polyuria has continued, but is much less severe, and the thirst much less. The change in the height and weight can be noted in Table 2, which gives his measurements from sixteen months up to the present time, twenty-eight months, with the average for the same age.

The outstanding features in this case are: (1) polyuria and polydipsia, (2) anorexia, (3) failure of growth, (4) definite improvement with pituitary and thyroid gland therapy.

The third case is somewhat different from the other 2 cases, but will be detailed, and then the 3 cases will be discussed.

Case III.—B. C., aged three years, female. Rectal temperature 99° F., pulse 112, and respirations 34.

The complaints on entering the hospital were extreme weakness and emaciation. The family history showed nothing bearing upon the present case.

Past History.—The birth was normal. She was breast-fed until past one year of age. Since then she has been on a milk and general soft diet. The development was normal up to one year of age. She crawled all over and could walk by holding on to chairs and pushing them ahead of her. At one year of

age she had an attack of diarrhea, and has had repeated attacks since. One year ago she had a severe stomatitis at the same time that others in the family had measles, but she had no skin eruption. About three or four months ago there was a period during which she had profuse sweating of the head, day and night. Five weeks before entering the hospital she had an attack of "swelling of the face and of the legs below the knee." She was not seen by any physician at this time, so the nature of this condition is unknown.

Physical Examination.—The patient was pale, emaciated and had an expression of discomfort. The skin was dry, and hung in loose folds about the neck, axilla, and groins. The hair was scanty and of fine texture. The eyelashes were very long. The head was normal in shape. The anterior fontanel was closed. There was no craniotabes.

There was no thoracic evidence of rachitis. The heart and lungs were normal.

The abdomen was markedly distended. There was a prominence of the abdominal veins and an umbilical hernia. The liver was palpable about 3 or 4 cm. below the costal margin. The spleen was not palpable.

There was an atrophy of the muscles of the extremities. The genitalia were normal.

She was very irritable and difficult to work with, but no organic defect of the nervous system was noted. She could talk, using single words and occasionally short sentences. Her memory was excellent, and she understood everything said to her. She could sit alone, but was unable to stand, crawl, or walk.

Laboratory Findings.—The urine occasionally showed a trace of albumin, but never any other abnormalities. The red blood-cell count was 3,150,000; hemoglobin, 70 per cent.; the white blood-cell count was 12,300; the lymphocytes predominated. The Wassermann test was negative. The von Pirquet test was negative.

An *x*-ray examination showed no abnormalities in head or chest. Gastro-intestinal *x*-ray examination was not made.

Body measurements and weight:

	Patient, age three years.	Average, age three years
Weight	14.5 lb.	31.2 lb.
Height	30.5 in.	35 in.
Circumference of head	17 in.	19.3 in.
Circumference of chest	19 in.	20.1 in.
Length of arm	9.5 in.	
Length of leg	10 in.	

Treatment and Progress.—During the first eight weeks (August to November) while in the hospital she was put on a general diet consisting of milk, cereals, potatoes, eggs, and fruit. The appetite at times was very poor. The diarrhea was intermittent. Toward the latter part of this period she developed a very marked tetany. The weight-curve was quite irregular, but showed a drop of 2 pounds from the time of entrance.

On November 8th, on account of the large amount of neutral fat appearing in the stool, a diet of very low fat with moderately high protein and carbohydrate was used. This diet consisted of skimmed milk, cottage cheese, finely ground beef or chicken, Eiweiss milk, well-cooked cereals, and orange juice. The weight at the beginning of this period (November 8th) was 14 pounds, and on December 21st, the end of the period, it was 12 pounds 2 ounces. The tetany had disappeared. There was a reduction in the amount of fat in the bowel movement, but there were still periods of diarrhea. The general weakness remained the same.

The third period was from December 21st to March 15th. The diet was about the same as in the second period. During time time the patient was given 2 grains of pancreatin and 2 grains of bile-salts in salol capsules four times daily, and cod-liver oil, 1 teaspoonful three times a day. During the latter part of the period the pancreatin and bile salts were increased to 5 grains three times daily. The weight December 21st was 14 pounds 2 ounces, and on March 15th was 14 pounds and 6 ounces. There was some improvement mentally, the irritability being less. Physically there was no change except for the increase in abdominal distention. The bile and pancreatin had no effect on the fat excreted, this ranging from 5 to 17 per cent. of stool. It was practically all in the form of neutral fat, the stools being invariably white and oily.

On March 15th the patient was put on a diet of dried milk, cottage cheese, lean beef, and fruit juices. As usual, upon changing diets, she refused to take the new food for a few days, and the weight dropped to 13 pounds and 2 ounces. By April 1st the weight had increased to 15 pounds. It stayed at this point until the 11th. At this time the patient contracted chickenpox. Immediately following the chickenpox, with no change in diet, she began to gain rapidly, and the weight increased at the rate of a pound a week. Her strength increased rapidly and she was able, within three weeks, to go around the ward on a "kiddy car," and took an active interest in the playing of the children in the ward.

By May 21st she was on a general diet, and was still progressing. She left the hospital on June 10th, with a weight of 24 pounds 8 ounces, a gain of about 10 pounds in two months. The bowel movements were more nearly normal in color and consistency.

In each of these cases there was a very noticeable defect in growth as well as in weight.

The only aspects of these cases which we will discuss at the present time are etiology, treatment, and prognosis.

Etiology.—In Cases I and II the outstanding feature is the diabetes insipidus. It is generally conceded that this condition is due to pituitary gland lesions. E. B. Towne in the discussion of pituitary lesions makes the statement, "all children who show retarded bodily and sexual development with or without adiposity, and especially if associated with headache or polyuria, should be considered pituitary insufficiency until proven otherwise." Morse says that the evidence as to the rôle of the pituitary gland in infantilism is conflicting, but that whatever evidence there is, seems to point to a hyposecretion of the pituitary gland. The experimental evidence so far obtained seems to indicate that if underfunction of the anterior lobe begins before full stature is attained the bones do not develop to the proper size, and some degree of normally proportioned dwarfism results. Also in these cases there is a failure of development of the external and internal genitalia, resulting in some

degree of sexual infantilism. Fröhlich's syndrome or dystrophia adiposogenitalis is a type of pituitary infantilism in which there is an associated obesity, sexual hypoplasia, and increased sugar tolerance. Neither of these cases presented Frölich's syndrome, but undoubtedly the extent to which the anterior or posterior lobe is affected, the time in the individual's life in which the condition begins, and the dysfunctioning of other glands of internal secretion may lead to a great variety of clinical pictures.

In Case II there was rather definite evidence of thyroid dysfunction such as dryness of the skin, coarse dry hair, subnormal temperature, and the improvement in these symptoms upon the administration of thyroid extract. A metabolism test should have been carried out for further evidence here. Diseases of the thyroid produce stunting of growth and failure of development as seen in cretinism and Brissaud's type of infantilism. The evidence, then, would point toward some involvement of the pituitary gland in both Case I and II, with probably thyroid involvement also in Case II.

Case III shows none of the evidence of internal secretion dysfunction shown in the other 2 cases. The clinical picture is clearly that of intestinal infantilism or celiac disease. The diagnosis is based upon the following symptoms, arrest of growth with emaciation, anemia, fatigue upon slight exertion, abdominal distention, at times diarrhea, and the presence of a large amount of fat in the stools.

There have been various etiologic factors given for this condition. Herter ascribed the condition to the absence of normal intestinal flora and the presence of gram-positive organisms in great excess. Still believes that there may be a real connection between scurvy and the development of celiac disease. The history of sore mouth in the present case is suggestive. However, since we do not have an accurate description of the condition of the mouth and no history of petechiæ or other signs of scurvy, we can attach no great importance to this one symptom. The peculiarity in this case is the rapid increase in growth immediately after the attack of chickenpox. Not in-

frequently we see cases in which there is a sudden marked improvement in the general nutritional condition following the recovery from some acute infectious disease. That this may be due to the activation of some of the glands of internal secretion is one of the possibilities.

Treatment.—The treatment of the first 2 cases is essentially the treatment of the diabetes insipidus. In Case I the hypodermic injection of the extract of the posterior lobe of the pituitary gland was tried for about three weeks. The amount of urine could be very strikingly reduced, but after twenty-four hours the condition was the same as ever. Pituitary extract (posterior lobe) was tried by mouth with no noticeable effect. The treatment eventually consisted of general hygienic measures, moderate restriction of fluid intake, low proteid diet, and the giving of the whole pituitary gland and thyroid gland substances by mouth.

In Case II the results of giving the pituitary and thyroid seemed to be very effective. There was an immediate and very definite improvement. Once or twice during the past year the powders have been discontinued for a short time, and there was an increase in thirst and polyuria as well as a failure to gain.

In Case III the usual high protein diet and general hygienic measures used in the treatment of celiac disease were carried out, but no effect resulted. The condition began to improve very suddenly without any change in treatment.

Prognosis.—Case I. This case was first seen at one year of age, and she is now eight years of age. She has had chickenpox, influenza, measles, pneumonia, and several attacks of upper respiratory infection during this time. For the last three years she has attended school regularly. The polyuria has made a definite improvement, and there has been a lessening of the thirst. She is still very much undersize and her present rate of development would indicate that she will probably be always undersize.

Case II. This baby was first seen at two weeks of age. He is now three and a half years old. For the last ten months

he has been gaining very rapidly. His gain in weight has been proportionately greater than his gain in height. He is almost of the Frölich's type at present. The polyuria and polydipsia show a decided improvement as do the skin and hair. I believe that Case II will gradually develop into a normal individual.

Case III. At the time of passing out from under observation this girl was apparently normal except that her gain in weight had been much greater, proportionately, than her gain in height.

Summary.—Three cases of defects in growth have been presented to illustrate some of the factors, other than food, which are of importance. Two of them were cases of pituitary dysfunction and one a case of Herter's intestinal infantilism.

CLINIC OF DR. EDWIN DAVIS

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PYELONEPHRITIS

ALTHOUGH the term "pyelitis" is in common usage, it is the consensus of opinion among those interested in urologic pathology that the term "pyelonephritis" may be more properly employed, in that all evidence is contrary to the conception that pyogenic infection may be exclusively limited to the mucosa of the renal pelvis. Pyelonephritis is an important subject, met with by each and every one of us, in general medical practice and in the specialties as well. The following cases, briefly summarized, illustrate important points bearing on etiology, diagnosis, and treatment.

Symptoms.—Pyelonephritis may be defined as a pyogenic inflammatory process, involving the mucosa of the pelvis and the renal substance, occurring in acute exacerbations and in chronic form, and manifested in general by pyuria, bladder symptoms, fever, and more or less pain in the flank. Both children and adults are affected. The amount of pus in the urine may show seemingly spontaneous day-to-day variation. Bacteria may also be demonstrated in the urine by microscope and culture. The most common bladder symptom is frequent urination, and with this varying degrees of urethral pain and burning. Pain in the flank may be conspicuous by its absence, even during acute exacerbations with high temperature and gross pyuria. The degree of pain depends upon the presence or absence of ureteral obstruction. More or less tenderness in the flank is ordinarily present during acute exacerbations. During the chronic course of the disease, fever is ordinarily absent.

Case I. Clinical Diagnosis of Recurrent, Acute Pyelonephritis, Based Upon Fever and Symptoms of Cystitis, and of Focal Infection Origin. Cure Following Tonsillectomy.—A girl of nineteen was first seen April, 1925, complaining of frequent urination, and urethral pain and burning during urination, and giving a history of onset with chilly sensations and fever (up to 102° F.) two weeks previously. There had also been one similar attack six months previously, with a duration of two or three weeks. Other than this, her general health had been good. She gave no history suggesting chronic nose and throat infection, nor had there been pain in the abdomen or in either flank.

Physical examination was essentially negative with the exception of evidence of chronic tonsillitis. The dental examination was negative. Neither kidney was palpable, nor was there anything to be made out by abdominal palpation. Temperature normal.

The urine obtained by catheter was slightly cloudy in the gross, and under the microscope showed numerous colon-like bacilli and a moderate number of pus-cells. No albumin.

Other than *x*-ray examination, which showed the outline of either kidney normal in size, shape and position, no further urological examination was considered necessary. There was no calculus.

The treatment consisted of daily mercurochrome instillations (0.5 per cent.), and tonsillectomy, carried out two weeks later. The latter procedure was followed by a temporary flare-up in symptoms.

The subsequent course of events has been entirely satisfactory, since the patient has remained symptom-free and the urine has been clear to date, over a period of almost three years.

Case II. Supposed Pyelonephritis found to be Unilateral Renal Tuberculosis. Cure Following Nephrectomy.—R. M., laborer, aged thirty-four, reported January, 1927 complaining chiefly of frequent urination of several months duration. This symptom had varied in intensity and had become worse during

past six weeks. There had also been indefinite dull, aching pain, intermittently present in the left flank during the past month, and patient had noted blood in the urine upon several recent occasions. His general health, however, was good. There was no history of fever, night-sweats, or loss in weight, nor was his family history of importance.

General physical examination, including that of chest and abdomen, as well as inspection and palpation of the external genitalia, and rectal palpation, was essentially negative.

The urine was cloudy in the gross, and under the microscope showed numerous pus-cells, a few red cells, and *no bacteria with the ordinary methylene-blue stain.* After several attempts the carbol-fuchsin stain of the urinary sediment showed acid-fast bacilli. There was a good trace of albumin.

Cystoscopic examination showed diffuse chronic inflammatory changes involving the vesical mucosa, and definite "pouting" and edema, with an areola of redness, around the left ureteral orifice. There was no actual ulceration. By ureteral catheterization, cloudy urine with 10 per cent. of 'phthalein was obtained from the left kidney, while the right kidney put out clear urine containing 30 per cent. of 'phthalein. Tubercle bacilli were likewise demonstrable in the urine from the left kidney. The plain *x*-ray film was negative. In the left pyelogram, however, the upper two calices showed some slight dilatation and a somewhat hazy, "worm-eaten" outline, suggesting small abscess cavities.

The treatment consisted of nephrectomy (left), and was followed by a clearing up of the bladder symptoms after an interval of two or three months.

Case III. Pyelonephritis Secondary to a Silent Calculus in the Pelvis of the Right Kidney.—R. L. D., middle-aged postal clerk, came in August, 1927, on account of frequency and burning on urination, and recurrent attacks, with chills, fever, and malaise dating back over a period of three years. He gave a history of loss in weight, and of feeling below par. There were also abdominal symptoms, characterized by indigestion and

indefinite epigastric pain, but characteristic renal pain was conspicuously absent.

The urine examinations during the period of observation showed quite a marked day-to-day variation. At its best the urine was almost clear in the gross, and microscopically showed a few pus-cells and bacilli; while at its worst it was distinctly cloudy. There was a trace of albumin.

General physical examination was essentially negative. During the course of a gastro-intestinal *x*-ray examination, a dense oval shadow (2 x $1\frac{1}{2}$ cm.) was discovered in the region of the right kidney, which was later shown by pyelography to lie within the pelvis of the right kidney. The pyelogram (right) showed a slightly dilated pelvis, but normal calices. Functional tests indicated a normally functioning kidney upon either side, although pus-cells and bacilli were obtained through the right ureteral catheter; none through the left.

Treatment consisted of pyelotomy (right), with removal of the calculus. Convalescence was uneventful. When last seen, three months following the operation, the patient had relief from his abdominal symptoms and, in a large measure, from his bladder symptoms. The urine, however, still contained pus-cells and bacilli. The tooth extraction program, advised upon the basis of the dental *x*-ray examination, had not been carried out; nor had the patient accepted the recommendation for tonsillectomy.

Case IV. Acute Onset, with Chills, Fever and Sepsis, due to Small Calculus Impacted at Ureteropelvic Junction. Dislodged by Ureteral Catheter, with Relief from Severe Symptoms.—The patient, a man of fifty-six, with a negative past history, seen December 10, 1927, had been acutely ill for several days with severe dull, aching pain, located in the left flank. Onset was quite sudden. Other than a moderate degree of frequent urination and urethral burning, there were no symptoms. During this period of several days there had been no relief other than that obtained by opiates.

Examination showed a rather poorly nourished man, evi-

dently septic. Temperature was 102° F., and leukocytosis 17,000. Abdominal palpation revealed definite tenderness in the left flank, but no actual palpable mass. Rectal palpation and examination of the external genitalia were negative.

The urine was cloudy in the gross, and contained many pus-cells and bacilli, as well as a good trace of albumin.

The plain *x*-ray film showed a small, dense, irregularly oval shadow, measuring 6 x 10 mm., and situated on the left side, just outside the tip of the transverse process of the third lumbar vertebra. The cystoscope showed nothing other than chronic inflammatory changes in the bladder. The ureteral catheters passed the length of either ureter without particular evidence of obstruction, the urine from the right kidney being clear, and containing the normal 'phthalein output. From the left kidney was obtained cloudy urine, containing pus-cells, bacilli, and only a trace of 'phthalein. The *x*-ray film with the catheter in place, and the pyelogram (left) demonstrated that the catheter tip had entered the renal pelvis, passing and dislodging a small calculus located at the ureteropelvic junction.

The subsequent history was in confirmation of the above diagnosis, in that the patient obtained immediate relief. The ureteral catheter was left in place over a period of three days. The temperature came down to normal upon the first day, and remained so. Operative removal of the calculus was advised and refused.

DISCUSSION

Etiology.—A consideration of etiology is of the utmost importance because of its bearing on diagnosis and treatment. There is abundant experimental evidence to the effect that bacteria may pass through the normal kidney and appear in the urine without the slightest clinical evidence of renal injury; and there is, therefore, sound basis for the statement that, in addition to the mere presence of the bacteria, an additional or predisposing cause is necessary. These causes are mainly obstructive in character, since any condition interfering with the normal drainage from the renal pelvis increases the susceptibility of that kidney to infection. The more common

underlying causes are hydronephrosis, nephroptosis, ureteral calculus, stricture or blood-clot, or external pressure upon the ureter due to a pregnant uterus, or to a pelvic new-growth or inflammatory mass. Chronic urethral obstruction, from any cause, is an equally potent factor. These are the local resistance-reducing causes which permit the bacteria to gain a foothold. The immediate and serious effect of ureteral blocking, with consequent infection and damage to the kidney, is illustrated by Case IV. The improvement in symptoms and in general condition and the condition of the kidney, following the displacement of the calculus with a catheter, is likewise to be noted.

Of equal if not greater importance, with respect to the etiology of pyelonephritis, is the subject of focal infection. There is abundant experimental and clinical evidence of the ability of bacteria in infected tonsils, teeth, sinuses, and prostates, and in stagnant colons, to initiate and perpetuate renal infections. An example of this is afforded by the relief obtained following tonsillectomy in Case I. Trauma due to calculus may set up and maintain a pyelonephritis, as illustrated by Case III. The susceptibility of the kidney to infection may likewise be increased by general systemic infection, particularly by the acute infectious fevers, as the result of toxic influences.

The majority of cases of pyelonephritis, as outlined above, may thus be explained upon either an obstructive, focal infection, traumatic (calculus) or toxic basis. There is, however, a group of these cases, usually bilateral, showing extreme chronicity and resistance to treatment, and presenting no evidence of relationship to any definitely demonstrable etiologic factor. It may be that these are cases of focal infection origin, and too deep seated and far advanced to respond at the time of institution of treatment.

Diagnosis.—Given a patient with typical symptoms of pyelonephritis, to make this diagnosis and let it go at that is *not* adequate. The question must be asked, "why has this patient a pyelonephritis?" Careful general physical examination may then reveal evidences of focal infection, or of systemic

infection; while complete urologic investigation may demonstrate some mechanical cause for ureteral stasis. The real diagnosis then comes to be not pyelonephritis, but ureteral stricture perhaps, or renal calculus or nephroptosis, as the case may be. Under these circumstances the pyelonephritis is entirely secondary, just as cystitis is almost always secondary to some other lesion. A very common error is the overlooking of renal tuberculosis as illustrated by Case II. Chronic pyonephrosis, with complete destruction of one kidney, may also go undiscovered over long periods of time. The group of cases of pyelonephritis most often overlooked, however, is made up of those without fever, pain or tenderness, or other symptoms directly referable to the kidney, the only evidence being pyuria (more or less), and varying degrees of frequent and painful urination. This is the group ordinarily diagnosed as cystitis, and often treated as such by local measures over long periods of time. Complete investigation, including ureteral catheterization, will give the answer in many cases of chronic "cystitis."

Not infrequently, very helpful diagnostic hints may be obtained by a careful consideration of certain more or less characteristic variations in the symptom combination. For instance, severe bladder symptoms of long duration, with extreme frequency of urination and particularly with a history of night-sweats and evening rise of temperature, are suggestive of renal tuberculosis. Bladder symptoms, associated with chronic, recurrent, dull aching pain in either flank, increased by jarring motion, with or without hematuria, suggest renal calculus. Sudden onset with extreme pain in the flank and high fever, and more or less evidence of sepsis suggests a blocking by an ureteral calculus in the presence of an infected urine. A long history with recurrent attacks of fever with aching pain in the flank, with pyuria and loss of weight and other evidences of sepsis, and perhaps a palpable, tender mass in the flank, suggests pyonephrosis. Thus, reasonably accurate diagnoses may often be made from a consideration of the symptomatology alone, and merely await confirmation by examination.

Treatment.—The *underlying* diagnosis gives the key to treatment. Thus pyelonephritis may be improved or cured by tooth extraction or tonsillectomy, or by ureteral dilatation, pelviolithotomy, or nephrectomy, or perhaps even by prostatectomy, or by other procedures as indicated. This subject has been well discussed by Braasch.[1] After complete investigation, and after the elimination of such possible local causes as ureteral stricture, calculus, nephroptosis, hydronephrosis, tuberculosis and pyonephrosis, the additional available methods of treatment may be briefly outlined as follows:

1. *Elimination of all possible foci of infection*, including attention to teeth, tonsils, sinuses, prostate, cervix, and intestinal stasis.

2. *Ureteral Dilatation.*—The question as to the importance of ureteral stricture has long been a subject of controversy. There is no doubt that brilliant results may occasionally be obtained in this way.

3. *Lavage of the Renal Pelvis.*—The drug most commonly used for instillation into the renal pelvis is silver nitrate, 1 to 2 per cent. solution. Various dyes have also been used. Continuous, ureteral catheter drainage of the renal pelvis is sometimes a valuable and life-saving procedure.

4. *Internal Medication.*—The question of internal urinary antisepsis is too involved for discussion here. Diuresis is of primary importance. The liberation of formalin by urotropin at the kidney level has been questioned by Hinman, and quite properly so. Acriflavin (in an alkaline urine) is of splendid experimental promise (Davis[2]), and is of proved value in a very fair percentage of acute cases. In chronic pyelitis, however, results are inconstant, and relapses are the rule rather than the exception. Clinical reports concerning hexylresorcinol[3] (also of experimental promise) are not encouraging. It is to be hoped, however, that the future may provide a clinically efficient drug for the purpose of internal urinary antisepsis.

5. *Intravenous Medication.*—There has been a limited intravenous use of mercurochrome,[4] acriflavin, and arsphenamin[5] in the treatment of pyelonephritis, and a few good results have

been reported. The subject of intravenous chemotherapy, however, is yet in its infancy.

6. *Vaccine Therapy.*—There is no substantial evidence of the value of vaccines (stock or autogenous) in the treatment of pyelonephritis.

Finally, it may be repeated that far more important than any known method of therapy in the case of pyelonephritis is the complete investigation of the urinary tract, in an effort to discover and eliminate the lesion primarily responsible.

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GRANULOMA COCCIDIOIDES

GRANULOMA coccidioides is an unusual disease. There are but 76 recorded cases, and the case before you is the first to be recognized in the State of Nebraska.

History.—The patient, aged twenty-six, was born in the Hawaiian Islands of American parents, and brought to the United States at the age of five months—since which time he has lived continuously in the States of Nebraska, Illinois, Wisconsin, and Michigan.

In 1924, he spent three months on a tour of the West Coast, which extended from Seattle to San Francisco and included a stay of two or three weeks in the San Joaquin Valley. He has attended school all his life, graduating from the University of Nebraska College of Agriculture in 1924, and at the present time is a junior in the University of Nebraska College of Medicine. His summer vacations have been spent for the most part in farm labor.

The month of September, 1926, was spent at the University of Pennsylvania in the laboratory of Dr. Fred Weidman, where he was engaged largely in research work with the organism Coccidioides immitis. He returned to the University of Nebraska, October 1st, where his research with fungi, including Coccidioides immitis, was pursued until the onset of the present illness.

There have been no previous illnesses of significance. His maxillary sinuses were drained in August, 1926, and he was given an autogenous staphylococcus vaccine as treatment of this condition following the drainage operation. Through an error, his initial dose of this vaccine was several times larger

than should have been given, and was followed by a rather severe reaction, characterized by cough, dyspnea, and inspiratory pain. These symptoms, with the exception of cough, disappeared after a few days, the cough persisting for two months. It is to be noted that during this time the patient was working with the organism Coccidioides immitis. His cough was of a mild character and unproductive, but caused sufficient annoyance for the patient to seek an examination of his chest, which examination was reported negative. During the succeeding six months, he did not feel quite up to standard, and there was a loss of a few pounds in weight.

During the latter part of April, 1927, he experienced three or four attacks of moderate chills and fever, and complained somewhat of general malaise, slight backache and headache, none of which were severe enough to interrupt his attendance at school. About this time, however, on one occasion following a moderate cough he noticed a small amount of blood-streaked sputum.

About May 15th, he experienced slight pain and swelling of the left foot, which gradually became more pronounced until May 21st, when he entered the University Hospital. At this time, his temperature was 102° F., and there was an intense throbbing pain in the left foot, moderate enlargement and pain in the inguinal glands, most pronounced on the left side, and a general feeling of malaise. Hot boric-acid wet dressings were applied to the foot, and ice-caps to the inguinal glands. Physical examination was negative except for a moderate pharyngitis with considerable postnasal discharge, an occasional premature contraction which was not considered significant, and the local findings as noted.

On May 23d, his temperature had returned to normal. However, the pain persisted in the foot which now showed considerable swelling and definite fluctuation on the plantar surface. A longitudinal incision was made in the mid-plantar area, and about 2 c.c. of dirty yellow pus found beneath the deep plantar fascia. In fresh smears made from this pus there was seen a spherical body, about 40 μ in diameter, with a double contoured refractile wall. The organism was carefully studied

by Dr. Myers and myself. The appearance of the organism and the fact that the patient had been working intensively with Coccidioides immitis seemed to justify a tentative diagnosis of coccidioidal granuloma.

The foot remained painful, and two additional incisions were made on May 29th, when about 3 ounces of pus were removed. Mature organisms of Coccidioides immitis were again demonstrated in smears of this pus, specimens of which were sent to Dr. Fred Weidman at the University of Pennsylvania, who confirmed our findings.

Treatment.—In a preliminary report of a case of granuloma coccidioides treated by intravenous injections of tartar emetic and the application of *x*-rays to the lesions, Guy of Pittsburgh reported favorable results. This plan of treatment was decided upon and a complete record of treatment to date follows:

Over a period of three months the patient has received 1 per cent. tartar emetic intravenously, at intervals of two days and in dosage ranging from 2 to 8 c.c. With increasing dosage, toxic symptoms, consisting of sharp rheumatic pains, nausea and vomiting, and finally fascicular twitchings of the entire skeletal musculature, developed. The reaction regularly occurred five hours following treatment, and persisted for from three to forty-eight hours. Its severity was in direct proportion to the dosage.

On two occasions, 8 and 20 c.c. respectively of the reported non-toxic 0.4 per cent. antimony thioglycollate was given intravenously. Severe reactions similar to those experienced with tartar emetic were noted, and administration of this alternate antimony compound was discontinued.

In addition to the intravenous tartar emetic the patient has received $\frac{1}{2}$ of a skin unit of *x*-ray, unfiltered, at from ten- to fourteen-day intervals.

Two stereoscopic films of the chest were made at an interval of three months. Interpretation of these films by Dr. Pierce was as follows: The film made in May demonstrated moderate increase in the density of the peribronchial markings, which might be associated with a chronic peribronchial infection. Comparison of the later study demonstrated some improvement

of the peribronchial markings, and probably is indicative of a reparative process. *x*-Ray studies of the affected foot demonstrated no pathologic change in the bones.

Under this conservative plan of treatment, the patient has gained 15 pounds in weight, and his feeling of well-being has returned. As you will note, the wounds have entirely healed. An occasional superficial accumulation of seropurulent material has formed. No organisms have been demonstrated in this material, and animal inoculations have been negative. We do not, however, feel certain that an absolute cure has been brought about, and case histories in which there has been a recurrence of activity after long periods of quiescence lead us to be still more skeptical on this point.

Molds or fungi have been recognized as pathogenic to the human host for almost a century, but until the work of Saboraud in 1890, little attention was given to this group of parasites. Since that time, however, and especially during the past decade, much has been written on this subject. Many eruptive changes formerly classified as eczema, pompholyx, dermatitis, hyperhidrosis, etc., are now known to be caused by fungi.

Much is yet to be learned about fungi.

Their life apart from the human host, classification, identication, immunity reactions, and the treatment of disease states which result from them, all offer attractive fields for research. Mitchell in a recent publication, has called our attention to the need for this research, particularly as regards treatment, which at the present time is not satisfactory. Coccidioides immitis is one of the least frequently encountered members of this family of parasites, and fortunately so, for case reports of infection with this organism are usually accompanied by autopsy findings.

The first report of a case of Coccidioides immitis was that of Wernicke in Buenos Ayres in 1892. In 1896, Rixford and Gilchrist first described the morphologic characteristics of the organism, and recorded their observation of its clinical and microscopic pathology.

In 1900, Ophuls more accurately described the life cycle of the organism and noted that it multiplied in the host by

endosporulation, a fact which definitely distinguishes this disease from blastomycosis, with which it was for a time confused.

Because of its wide range of pathologic manifestations, the disease is of interest in all branches of medicine. In the 76 recorded cases, it has been found to involve all of the body structures. It has been confused with other fungous diseases, osteomyelitis, meningitis, tuberculosis, etc., and in at least 40 per cent. of the cases diagnosis was made postmortem. Of the 76 reported cases, the records are complete in 61. Of this

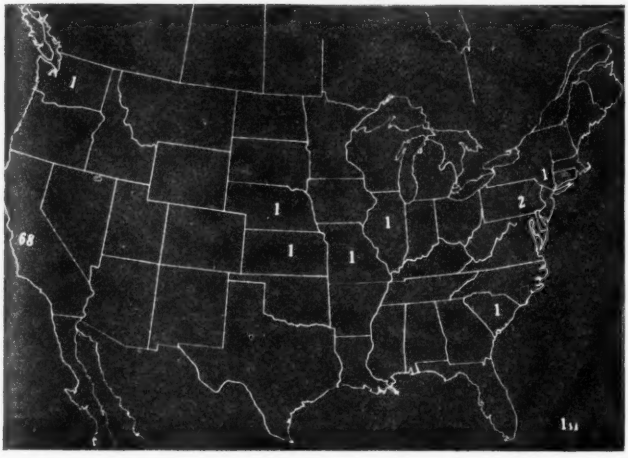

Fig. 83.

number 83 per cent. are known to have died, 7 per cent. are reported as still under observation, and 10 per cent. have shown remission of the disease of from two to nine years.

From the spot-map it will be seen that a very high percentage of reported cases have been found in California. The majority of these in the San Joaquin Valley. No satisfactory explanation of this fact is forthcoming. From a consideration of isolated cases such as has occurred in South America, and another who had spent her entire life on an island in South Carolina, it would appear improbable that the life of this organism apart

from the human host is confined to California. We do not feel that the sojourn of this patient in that locality three years ago is responsible for his infection. Rather, it is our opinion that his infection occurred while working with the organism in the laboratory.

Ahlfeldt has quite conclusively shown through animal experimentation that infection may take place by way of the skin, or through the gastro-intestinal or respiratory tracts. Her experiments also indicated that the lungs offered the most common portal of entry.

As has been mentioned, the symptoms of Coccidioides immitis infection are extremely protean in character. However, the following should suggest the possibility of this disease:

1. Pulmonary symptoms of obscure etiology, particularly in the absence of tubercle bacilli in the sputum. 2. Subacute or chronic inflammatory lesions of the skin, granulomatous in character. 3. Deep-seated abscesses particularly in patients whose history bears evidence of preëxisting pulmonary disease.

Compounds of antimony have long been employed in medicine. Apparently they are of therapeutic value only when administered intravenously. Theoretically, its value is dependent upon its general physiologic stimulation of body tissues. Toxic manifestations from the drug are definite and well marked. Christoferson and Gloyne are of the opinion that these toxic reactions are allergic in character. Our own experience would not indicate that this is the case, as a reduction of the dose was not followed by reactions. Possibly a better explanation of these reactions is offered by Griffith-Jones, who found definite amounts of arsenic and lead in all samples examined.

The value of *x*-ray in the treatment of granulomatous structures is well recognized, and it is known to have an almost specific action on other fungus infections, notably in the treatment of sporotrichosis and blastomycetic dermatitis. A definite explanation for this favorable influence is wanting, but it is probably best expressed by McKee, who states that the *x*-ray has a profoundly stimulating effect on all lymphatic structures.

CLINIC OF DR. W. A. KILLINS

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GOITER

Case I.—I wish to present 3 cases of thyroid disease. The first is that of an Italian girl, thirteen years of age, whom I first saw September 7, 1927. Her chief complaint was an enlargement in the region of the thyroid, which had been noticed first by her parents three weeks previously. Since its appearance, it had increased quite rapidly in size, but at no time had there been pain or tenderness. For the past two months she had fatigued more easily than usual. The family history is of no significance. She had suffered no past illnesses of consequence aside from occasional sore throats. Menstruation had not yet been established. The thyroid was firm and symmetrically enlarged, each lobe giving the sense of a mass about 5 x 4 x 2 cm. There were no bruits or thrills demonstrable over the thyroid vessels. The rapidity of development, together with the very firm consistency, made us think of the possibility of thyroiditis, but the absence of pain or tenderness seemed to rule it out. The tonsils were large and soft, and contained numerous firm follicular plugs. The blood-count and urinalysis were within normal limits, and the pulse rate was 94 at the time of the first examination, with a blood-pressure of 114 systolic, and 72 diastolic. The basal metabolic rate was minus 7 per cent.

Our diagnosis of this case was colloid goiter of recent development, and we felt that it should be an excellent case for medical management. We, therefore, prescribed 1 grain of the extract of desiccated thyroid three times daily for one week. At the end of that time, finding the metabolic rate plus 5 per cent. and the gland very much softer and definitely reduced in size, the dose was reduced to 1 grain of the extract daily. By the end of

the third week, it was hardly possible to detect any increase in the size of the gland above normal. At present, she is still taking 1 grain of thyroid extract daily and, as you can see, there is no visible swelling in the neck, although if you were to carefully palpate the gland, a barely demonstrable enlargement persists.

Comment.—This case is a classical example of colloid, adolescent, or simple goiter, and furnishes evidence in support of Plummer's theory of the etiology of such thyroid enlargements. The usual text-book explanation, that colloid goiter is a resting gland does not seem tenable in view of repeated experiences similar to the one reported here. According to Plummer's hypothesis, the function of the thyroid gland is the elaboration and delivery to the blood-stream of sufficient thyroxin to maintain the total amount in the tissues of the average adult at approximately 14 mg. The question is often asked, how can anyone tell the amount of thyroxin in the body when it is present in such minute amounts. This was determined experimentally by Boothby and his co-workers in their work on patients suffering from a high grade of myxedema. It is known that the thyroid gland regulates approximately 40 per cent. of the body metabolism, and consequently a patient in whom there seems to be no functioning thyroid tissue will have a basal metabolic rate of about 40 per cent. below the average normal. If such a patient is given 14 mg. of thyroxin intravenously, the metabolic rate will rise gradually, reaching normal in about seven days—maintaining this level for one week and then the rate of metabolism gradually falls, striking its former level about three weeks after the injection. If, while the metabolic rate is normal, a small amount of thyroxin averaging 0.33 mg. is given daily, the rate of metabolism is maintained at normal. The function of the thyroid is therefore assumed to be the elaboration and delivery into the blood-stream of this small amount of thyroxin, and any tendency for the metabolism to fall below normal, that is, for actual or potential hypothyroidism to appear, acts as a stimulus to the gland. In the case we have just seen, we assume that she was born with a normal thyroid gland and that it continued to function normally through infancy and

childhood. She is now entering upon a period of changing metabolism, incident to more rapid growth of the body and the development of the reproductive organs. During this period of metabolic stress, there must be a demand on the thyroid gland for more thyroxin. We can, therefore, visualize the thyroid in this case as being constantly stimulated, and endeavoring to produce more thyroxin. Failing in its effort to produce thyroxin, we believe the gland stores colloid. Through the work of Marine and Kimball, we have learned that the reason the gland does not respond normally is a deficiency of iodin in the food and water supply. These investigators have shown that the administration of small amounts of iodin at regular intervals to children during early childhood will prevent the occurrence of colloid goiter. After the colloid has once been deposited, iodin is not ordinarily effective in causing it to disappear. If this theory of the production of colloid goiter is correct, the administration of sufficient thyroid to the body to remove the stimulus from the gland should allow the gland to rest and the colloid to be absorbed. This is especially to be expected in cases like the one shown, in which the enlargement is of short duration. You have seen how well this case responded. She will continue to take small doses of thyroid extract for six months, then iodin in the form of Lugol's solution will be substituted in doses of drops, 3 daily, one week of each month. If no evidence of return of the goiter appears, she will take iodin for two years, at the end of which time all medication will be discontinued. We do not know whether she is any more liable to thyroid disturbances later in life than she would have been had she had a normally functioning gland during adolescence.

Case II.—The second case is that of a girl fourteen years of age who complains of a swelling in the neck, first noticed by the school nurse four years ago. It enlarged quite rapidly until it became very noticeable, but was not disfiguring until the past few months when it has grown to its present size. There have been no other signs or symptoms of thyroid disturbance. When

we inquire into her past history, we find that she had measles and mumps in childhood and has had occasional sore throats. Menstruation began three months ago and has been regular and painless. The amount of menstrual flow has been normal. There is nothing in the family history of significance.

On examination we find a very well-developed girl, who appears to be older than her stated age. Her general examination is entirely negative except for the thyroid, which is symmetrically enlarged, soft, and gives one the impression that it is cystic. The lateral lobes are approximately 6 x 4 x 3 cm., and middle lobe about 3 x 4 cm. There are no palpable nodules and no bruits or thrills are demonstrable. The blood-pressure is 112 systolic, and 80 diastolic. The basal metabolic rate is minus 20 per cent.

Comment.—The physiologic stimulus to the thyroid gland brought about by actual or potential hypothyroidism results first in the storage of colloid and the formation of true colloid goiter. If this same stimulus continues to act on the gland over a longer period of time, the gland further responds by the formation of new acini. If these new acini are encapsulated, the well known thyroid adenoma is formed, but if they are not surrounded by a capsule and are scattered in clumps throughout the gland, a condition described by MacCarty and called by him "adenomatosis" is the result. The case reported illustrates a disorder of the thyroid usually termed "colloid goiter," but is probably more accurately classified as adenomatous goiter without hyperthyroidism. These cases do not ordinarily respond to the administration of thyroid extract in amounts sufficient to maintain the basal metabolic rate at normal.

There is a type of large colloid goiter, characterized by the presence of bruits and thrills over the thyroid vessels, indicative of greatly increased vascularity, that does respond in a most spectacular manner to the administration of thyroid extract or thyroxin. It is not unusual for a large, vascular colloid goiter to reduce in size one-half within a few hours after the administration of a single dose of thyroxin intravenously. These vascular colloid goiters are not common.

In the case we have seen today, thyroid extract will be given in sufficient quantities to raise the basal metabolic rate to normal. This will probably reduce the goiter only slightly because of the duration of the enlargement, and because the gland has probably responded by the formation of new acini. After the metabolic rate has been normal for a few days, a sub-total resection of the thyroid will be advised, because of the disfiguration caused by its presence and because it is a potential source of danger later in life. Following operation, the metabolic rate will be maintained at normal by adequate doses of thyroid extract in order to remove the stimulus from the gland. If this is not done, and the stimulus on the remnant of the gland persists, the result will be the storage of more colloid and the recurrence of the goiter. The systematic elevation of the metabolic rate before operation, and the maintenance of a normal rate after operation, will serve to put the gland at rest and reduce the percentage of recurrence in such cases to a negligible minimum. It is not unusual to see such cases that have had two or more resections of the gland, each followed promptly by a recurrence of the goiter and each serving to further handicap the gland until a frank operative myxedema results.

Case III.—The next case is that of a woman, aged fifty-eight, the mother of three children, who complains of nervousness, weakness, diarrhea, and loss of weight. She had the usual childhood diseases, but was never seriously ill, and had considered herself in perfect health until eighteen months ago, when she noticed that she was more irritable and became easily upset by things that had formerly caused her no concern. Her heart would beat rapidly, and she became short of breath on slight exertion. These symptoms were present for several months, and then for a period of about four months she felt much better, and was able to do her ordinary household work without difficulty. Six months ago the symptoms returned with increased severity and she began to lose weight rapidly. She had no nausea or vomiting at any time, but for two months preceding her entrance into the University Hospital she was troubled by

diarrhea, passing three to five loose stools during each day and two or three at night. She had lost a great deal of weight and was extremely weak and nervous.

At the time of her examination in October, 1927, she weighed 90 pounds, which represented a loss of one-half of her body weight in four months. She was extremely stimulated, constantly threshing about, making purposeful, but useless movements, so that she could be kept in bed only with difficulty. The skin was warm and velvety, and hung in loose folds over the arms and legs. Over the elbows and sacrum it was reddened and tender from constant friction on the bedclothes. No exophthalmos was present, but her eyes had a peculiar wild look or stare giving her an expression that has been aptly termed one of "frozen fright." Her teeth had almost all been extracted, but the few remaining seemed solid and in good condition. The tonsils were small and fibrous and yielded nothing on firm pressure. The thyroid was firm and symmetrically enlarged so that it could be easily palpated and gave a slightly irregular or nodular sensation to the examining fingers. The cervical veins were widely dilated, and over the superior thyroid vessels a distinct bruit was audible. The heart rate was rapid, averaging about 140 beats each minute, but was not demonstrably enlarged, and has been regular at all times. The liver was not palpable and the abdomen showed no abnormality aside from evidence of the extreme loss of weight. There was a fine tremor present in the outstretched fingers, but the trophic changes in the nails so commonly seen in exophthalmic goiter cases were not evident. There was great muscular weakness, most apparent in the quadriceps femoris, so that she could not raise her foot to the seat of an ordinary chair.

Laboratory studies, including blood-count, urinalysis, *x*-ray of the chest, non-protein nitrogen and sugar determination on the blood were all negative. It was impossible to determine the basal metabolic rate for several days after entrance into the hospital, because of the extreme restlessness. Five days after admission, and after the administration of Lugol's solution

10 minimin doses, five times daily for four days, the metabolic rate was 65 per cent. above normal.

Our diagnosis in this case is exophthalmic goiter, based on the presence of an enlarged, symmetrical thyroid gland, which has been present only since the onset of the illness, the history of remissions and exacerbations of the disease, the presence of bruits over the thyroid vessels, and the peculiar nervousness which she exhibits. The presence of these signs and symptoms warrant the diagnosis of exophthalmic goiter even in the absence of exophthalmos, which has been found by Plummer to be present in only about 65 per cent. of the cases that are proved by pathologic examination to have undergone the diffuse parenchymatous hypertrophy characteristic of this disease.

This patient is still very ill. While her pulse rate has dropped, and her general condition has improved after taking Lugol's solution for one week, she continues to be highly emotional, crying frequently and begging to be allowed to go home. The diarrhea which was so distressing to her is considerably improved, so that she now has two or three loose stools during the day, and none at night. We are confident that within the next few days she will become much more quiet and begin to gain weight and strength, and that she will be much more stable emotionally. As soon as she has become quiet and has gained strength, sub-total resection of the gland will be advised. Before the introduction of Lugol's solution in the preoperative treatment of these cases, a primary thyroidectomy in such a case as this would have been very dangerous. She would probably have required hot water injections, followed by multiple ligations, each procedure fraught with more danger than the radical primary resection since the use of iodin. The degree of stimulation and the patient's strength are probably the best criteria as to the time of operation. If exophthalmic goiter cases are emotionally stable and are strong enough to step onto the seat of an ordinary chair without assistance, they will usually go through operative procedures much more safely than those cases in whom the pulse-rate and metabolism are lower, but who are weak and appear stimulated.

The diagnosis of exophthalmic goiter in elderly individuals is not always easy. There is rarely a history of a thyroid enlargement preceding the onset of the illness and, in persons over fifty-five years of age, it is unusual for the patient to be aware that there is any swelling in the neck even after the disease has been present for a period of months or years. The gland is usually small, symmetrically enlarged, and often feels finely nodular under the palpating fingers. This irregularity of contour of the gland, however, is rarely due to adenomata as would be the case in younger persons, but is usually due to bulging of the parenchyma through the firm fibrous septa of the gland. Bruits are often present over the gland, but do not have the same degree of intensity as those in younger patients with equally severe hyperplastic goiters.

There is perhaps no disease occurring in elderly patients, which causes such rapid and marked emaciation as exophthalmic goiter. In younger people with increased appetite and rapid loss of weight, diabetes is always a possibility, but it is unusual to see the older diabetic lose weight rapidly. The occasional finding of a trace of sugar in the urine in patients with thyroid disease has caused many of them to be treated for long periods of time for diabetes. The result of restriction of carbohydrate consumption in patients with hyperthyroidism is likely to be disastrous, and the corroboration of the diagnosis of diabetes by blood-sugar and glucose tolerance determinations cannot be too strongly urged. In any case in which the constitutional symptoms seem out of proportion to the severity of the diabetes, it is well to consider the possibility of hyperthyroidism.

The patient past middle life suffering from exophthalmic goiter often has quite marked gastro-intestinal symptoms, particularly diarrhea. Less frequently, occasional vomiting is present. These symptoms differ from the typical gastro-intestinal crises of exophthalmic goiter in that they may persist over a period of weeks or months, and they occur in patients in whom the intensity of stimulation from the diseased thyroid would not warrant the diagnosis of crisis. The association of intestinal symptoms and rapid weight loss suggests the possibility

of abdominal malignancy, and that was the tentative diagnosis in the case we have seen, at the time she entered the hospital. Diarrhea of this type responds well to Lugol's solution, but only as the general condition of the patient improves. The diarrhea of exophthalmic goiter crisis responds much more promptly to the administration of iodin than does the less acute type which is most frequently seen in older patients.

CLINIC OF DR. LYNN T. HALL

UNIVERSITY OF NEBRASKA, COLLEGE OF MEDICINE

CHRONIC INFECTIOUS ARTHRITIS, WITH REPORT OF CASES AND TREATMENT

No disease invades so many fields of medicine as arthritis. On this account, many difficulties have arisen with reference to classifications, and to the adoption of satisfactory methods of handling patients. Many laymen, and even some physicians, still regard the disease as incurable. Thus regarded, patients suffering from this disease are left to endure a life of pain and to become a definite economic loss to society. It is an extremely prevalent disease, and its refractory nature presents a challenge to every clinician. Vigorous study of cases and sustained and intensive treatment must be provided for the attainment of a favorable result. This is not always possible on account of the patient's financial status, which will not allow for the prolonged treatment and required medical attendance.

Of all forms of joint disease, Chronic Infectious Arthritis is by far the most common seen in this vicinity. The purpose of this clinic is to discuss more definite means of distinguishing the disease from other forms of arthritis, and to discuss various measures employed in its treatment. I wish to present several typical examples of chronic infectious arthritis:

Case I.—Mrs. J. M., housewife, aged twenty-nine, entered the University Hospital complaining of (1) pain in the small joints of hand and shoulder; (2) slight fever; (3) headache; (4) feeling of numbness in neck, with choking sensation; (5) nervousness. The pain began four months ago, with stiffness in the joints. Tonsillectomy was performed one month ago. Serum

and drugs had been given, and helped as long as the patient remained in bed. Present condition about the same as the past four months.

Family History.—Negative.

Previous History.—Childhood: Smallpox, mumps, measles. No adult disease except the present. No injuries or operations. No history of infection of ears, nose, throat. Gastro-intestinal and cardiovascular history was negative. Menstrual history was negative. Two miscarriages at eight months, cause not determined. Loss of weight of 15 pounds in last six months.

Physical Examination.—The nutrition is poor and the patient appears anemic. The pupils are normal; hearing is good; no auricular or nasal discharge. The tongue is clean; the tonsils were removed; the pharynx is inflamed. The teeth appear to be in good condition. The lungs are negative; heart, negative; rate, 69; blood-pressure, 100/70. The extremities are negative except the phalangeal joints, which are deformed by chronic arthritic process.

Laboratory Findings.—The urine is negative. The red blood-cell count was 4,230,000; hemoglobin, 70 per cent.; white blood-cell count, 7900; polymorphonuclears, 68 per cent.; lymphocytes, 32 per cent. The basal metabolic rate, normal. *x*-Rays of the teeth showed four to be abscessed. Fever never above 99.2. The blood Wassermann test is negative.

Treatment consisted of administration of general diet, hygenic care, removal of abscessed teeth, including alveolectomy. Sodium iodid 30 to 50 gr. intravenously on alternate days. Oxyliodid, massage, and heat. Left hospital much improved one month after entrance.

Case II.—Mrs. A. S., housewife, aged thirty-one, entered the University Hospital complaining of swelling of the ends of fingers. This was noticed for the first time one year previously. The first phalangeal joint of the index-finger of the left hand became enlarged, then other fingers developed enlargements which were tender. They began to throb and became painful.

Past History.—Measles in childhood. No illness reported

in adult life. Wears glasses when reading. Some sweating with pain, but not marked. Has lost some weight. The family history is negative.

Physical Examination.—The patient appeared to be below normal. The teeth were questionable, several bad teeth being present. The pillars of the tonsils were infected, the tonsils were buried, and there was cheesy material present in the crypts. The extremities showed fusiform or spindle-shaped enlargements of all fingers and joints. A large joint between the first and second phalanx of the left hand was painful. Others were not. The basal metabolic rate was normal.

Treatment.—Consisted of removal of tonsils which were found to be badly diseased, and advice given concerning the teeth. After leaving the hospital, oxyliodid was employed with some success. Patient had teeth extracted and continued with the medicine, massage, and heat. When last seen, one year after the stay in the hospital, there had been considerable improvement.

Case III.—M. A., female, aged twenty-two, 5 feet 6 inches in height; weight was 124 pounds; occupation, stenographer. Noticed pain in the left foot and ankle for past two years, followed by tenderness in the distal phalangeal joints of both hands.

Family History.—Negative.

Past History.—There was no history of tonsillitis or exanthematous disease in childhood. She had influenza in 1918, and bronchitis and colds since.

Physical examination revealed swelling and tenderness in phalangeal joints of both hands. *x*-Ray examination of the teeth showed four badly abscessed, and these were removed. Tonsils were removed and found to be abscessed.

Laboratory Findings.—The urine was negative. Blood-pressure, 110/76. Metabolic rate, normal. Blood-chemistry, normal. Wassermann test, negative.

Treatment.—Heat, massage, diet, oxyliodid used first, and ten injections of 1 gm. ortho-iodoxy-benzoic acid (amiodoxyl benzoate) intravenously, twice a week, absolutely relieved the

painful joints, lessened the muscle spasm, and reduced the joint-swellings. She was last seen six days ago, six months after the last treatment. There has been no discomfort since.

Discussion.—As a preface to a discussion of these cases, and to some suggestions regarding treatment and diagnosis, it may be well for us to remember that practically all joint-disease of chronic character is secondary to some condition elsewhere. The process in the joint is caused by toxins resulting from the primary disturbance which may be metabolic or infectious, or both. With the exception of gout, there is no truly metabolic example of arthritis. There are some rare forms of arthritis, such as one sees after an injection of serum (anaphylactic phenomenon), joint-trouble in hemophilia, certain types of arthritis after the menopause, and the traumatic joints of Charcot, which should be remembered before final realization that all other forms are infectious. If arthritis due to specific infections, such as gonorrhea, tuberculosis, etc., is excluded, chronic infectious arthritis includes nearly all the types that remain, and is typified by a picture of proliferation of distinctly inflammatory character in the joint, generally moving from joint to joint, and usually associated with one or more foci of infection.

Etiology.—Teeth and tonsils have been found to be the most common foci of infection, but all of the other organs of the body may contribute infectious material in some instances. Organisms, having reached a joint in an original invasion may act as a subsequent focus of infection. In other words, an infected joint itself acts as a focus, and may explain the lack of relief noted in cases where every suspected focus has been removed. Females seem to be more often afflicted than males, and the age of onset is usually in early adult life. Cases here, have occurred from the teens to the fourth decade. All races and nationalities are victims, and no occupational predispositions have been noted. Grief, nervous shock, physical and mental strain are important factors. The strain of the teacher or typist who also works at her home, poverty, responsibility, and worry, nervous temperament, poor physical strength,

anemia, malnutrition, low blood-pressure, low pulse-pressure, and inactivity, all may predispose to this disease.

Pathology.—Examination of joints by the Roentgen ray discloses a rather uniform involvement of synovial and periarticular tissues. The typical change is one of proliferation and

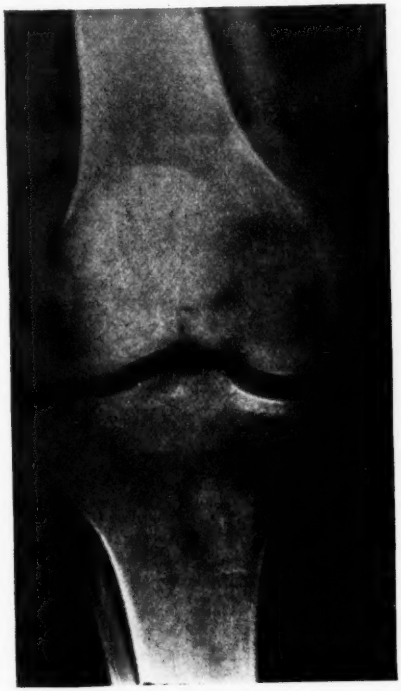

Fig. 84.—A normal joint. The method described on page 482 was employed. Presented through the courtesy of Dr. Robert Werndorf of Council Bluffs, Iowa.

is not noted in the articular cartilages. Slight changes in the margin of articular surfaces of bones have been noted in cases of long standing, but are rather excrescences or lippings than degenerative changes which are not seen in chronic infectious arthritis.

A technic for injection of oxygen or nitrogen into a joint has been developed recently which brings out sharply the shadows of soft parts under the Roentgen ray. These examinations have been of great value in prognosis and treatment. The swelling of the joints, particularly the fusiform types, furnishes

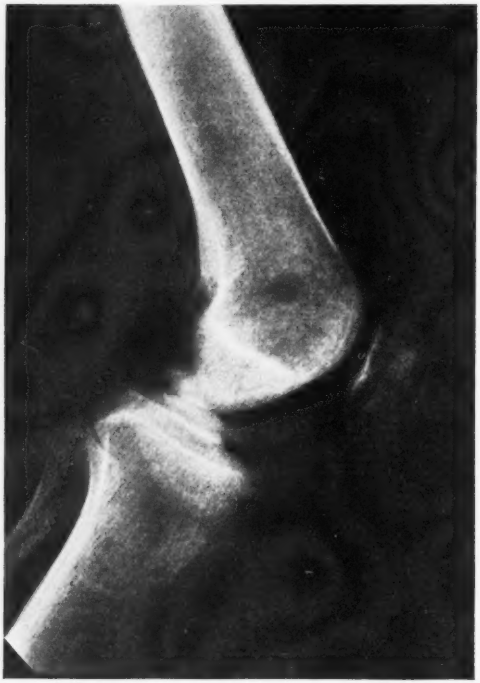

Fig. 85.—A normal joint. The method described on page 482 was employed. Presented through the courtesy of Dr. Robert Werndorf of Council Bluffs, Iowa.

visible evidences of the pathology of this disease. Oxygen-gas is admitted to the joint by means of a needle. The amount and pressure of the gas is carefully controlled by a specially devised apparatus for that purpose. I wish to present two films of a knee-joint that were obtained by this method. Study of these

records will show the lateral ligaments, the semilunar cartilages, and the posterior crucial ligament. The lateral view shows the cartilage of the patella and the posterior portion of the socket.

Symptomatology.—The onset is sometimes referable to some acute infection, exposure to cold, fatigue, a run down nervous state, a surgical operation or injury, but many present or complain of no immediate cause or predisposing factor. The outstanding symptom is pain in greater or less degree, produced by motion of the joint. It may develop gradually or slowly, and varies from stiffness of the joint to actual pain with redness, swelling, and heat. It is generally a migrating disease at its onset, appearing in first one joint and then another. Later, after several attacks, considerable disability ensues from pain on motion and weakness in the muscles due to disuse. Lack of motion is more dependent upon the tonus of these non-used muscles than it is upon the integrity of a joint articular hinge and, therefore, ankylosis may occur if the disease is not carefully checked by exercises and by the institution of means to control pain. Fever is uncommon later on in the disease. Sweating is not as profuse as in acute rheumatic fever.

Clinical Examination.—As may be recalled from a study of the cases presented, the characteristic features of the disease were most striking, viz., the adult patient who was underweight and run down from one cause or another, and who gave a history of painful joints, which pain jumped from one joint to the other. Many of the cases coming to this clinic have been notably undernourished or even chronically ill, some having actual organic disease with anemia, low blood-pressure, and weakened heart-muscles, and loss of weight. Cases seen in private practice, while conforming in general to the above, have in some instances, not been emaciated or run down, but in the earlier stages of the disease, have appeared to be robust, and apparently well in every particular with the exception of the joint involvement. Because of the importance of foci of infection in these cases, one should never overlook the sites of the chief offenders, namely the tonsils, accessory sinuses, and the teeth and gums. An infected tonsil which is red, swollen, and full of pus is obviously a men-

ace, but it is not always possible to place a correct appraisal upon a tonsil by inspection or by any of the usual forms of examination. In this connection the correct procedure should include the sacrifice of the tonsils whenever suspicion points strongly in their direction. Many times a small tonsil, buried or hidden behind the pillars, is found to contain liquid pus laden with virulent organisms. The pharynx may be noted to possess a corrugated lymphatic enlargement due to inflammation and hypertrophy.

The teeth may be apparently normal by inspection and by the Roentgen-ray examination, yet a virulent focus may be harbored in the surrounding gums and gingival tissues. Dead teeth are offenders with marked frequency, and should be ruled upon by a competent dentist.

The lungs may be the site of tuberculous infection, either active or inactive, but influence the arthritis only indirectly. Tuberculous pleurisy is seldom seen and, when present, the arthritis is not attributed to it. When the heart is found to have definite organic lesions, the ear-marks of earlier infection (from exanthematous disease or rheumatic fever) are evident. The blood-pressure is generally low. The hearts are usually normal. Tenderness over the gall-bladder and enlarged and swollen prostates may attract ones attention when encountered in the examination of the abdomen and viscera. We have seen no cases of infectious arthritis which we could attribute to infection of the female generative organs or adnexa.

The nervous system is affected in some cases of arthritis. Speculation as to the origin of these conditions suggests changes in the circulatory system as the most likely cause. The infection producing the arthritis does not seem to be the cause of the trouble.

Inspection of an early case of arthritis of this type reveals slight swelling of the periarticular structure, and some redness and heat. It is not a true synovitis, with an increase of synovial fluid, but rather an edematous condition due to inflammatory exudate into the tissues. As the condition advances, motion becomes more painful and limited. Bony changes are seen

in some cases, and in others the fibrous organization of the structure about the joint suggests a bony proliferation. The muscles atrophy with lack of motion and increase of ankylosis. The longer the case has persisted, the more likely we are to find bony changes. One occasionally sees an early case such as those presented, in which these changes have not occurred, and where there is nothing abnormal found upon inspection. There is some tenderness on motion and upon palpation.

Special Tests and Examinations.—We have made repeated efforts in this clinic to take cultures of material from the joints themselves. Cultures from foci of infection have also been taken, and we have tried to establish a parallel or coincidence in the findings in the various cases studied. No data of striking value have been derived from such studies, although the findings have been in general accord with the reports of many observers. The Streptococcus viridans and Streptococcus hemolyticus have been found with considerable regularity, and have been looked upon as the infectious agents. Other organisms were found less frequently.

The metabolic rate of 16 cases of arthritis was determined two years ago when studying this disease in our clinic. The results were negative. Examinations of the blood with reference to the content of sugar, urea, uric acid, non-protein nitrogen, and creatinin have been made and were likewise negative. In some instances there was a rather high sugar-level noted; 120 to 130 mg. was regarded as exceeding the normal limits. These findings have suggested that the metabolism of the patient is really not at fault *per se*, but that in an undernourished individual, who is run down, anemic, or suffering from the products of infection, there is a resulting inability to handle carbohydrates normally. Earlier efforts to restrict meats and acids apparently were not helpful, nor based upon correct data. Protein metabolism seems to have little to do with this disease.

The blood-examination has revealed a diminution in red cells and hemoglobin in nearly every instance. The white cells have been increased at times, but the differential counts have conformed to the normal relation of the polymorphonuclears

and lymphocytes. The Wassermann reaction is negative in all uncomplicated cases of true infectious arthritis. The same is true of the gonococcus complement-fixation test.

Diagnosis.—A typical case of infectious arthritis is characterized by rather constant findings:

1. Foci of infection are generally demonstrable.
2. There is a lack of rise of temperature, sweating, and the heart symptoms which one finds in rheumatic fever.
3. Involvement of the joints of the finger is common.
4. It is more likely to occur in young adults.
5. It is migratory.
6. It occurs with frequency in persons who are underweight, undernourished, and anemic.

One is generally able to distinguish between infectious arthritis and rheumatic fever. The severity of rheumatic fever, the sweats, the rise of temperature, and the fact that the symptoms abate with the use of salicylates are all opposed to what is noted in infectious arthritis. Gonorrheal arthritis is characterized by mono-articular involvement of the joints, and the history of focus in the genito-urinary tract or confirmation by complement-fixation tests. Gout is characterized by the slow onset, the occurrence in older individuals, the lack of typical joint-pathology, the presence of sodium urate in the nodules about the joints, and no relation of the disease to demonstrable foci of infection. Tuberculous joints, the infantile forms of Still, Charcot or traumatic joints, and other forms previously mentioned such as those seen in hemophilia, after injections of serum, at the menopause, and in specific infections may be differentiated by inspection, location, history, and course of the disease.

Treatment.—Chronic infectious arthritis is extremely refractory to treatment under the best of circumstances. With co-operation of the patient, and painstaking effort on the part of the physician, much may be accomplished. The success of treatment depends largely upon the duration of disease. Those cases treated early offer the best chance of relief or recovery. Deformities are prevented and by the institution of proper therapy and eradication of foci, tissues may be spared before

they are unalterably changed. Cases that have persisted for four or five years do not give the favorable results that may be obtained in cases whose duration is but a few months.

In our clinic the method of prodecure in the treatment of these cases has been (1) the removal of all demonstrable foci of infection, (2) medicinal treatment, (3) vaccines, (4) foreign protein therapy, (5) physiotherapy, and (6) the use of such special treatment as has been required of orthopedists and other specialists on our staff, but we have felt that the most definite improvement has been noted following the removal of such foci as teeth and tonsils. However, the full effects here are not apparent until five or six months afterward. Sinuses, the middle ear, gallbladders, prostates, and bladders have been treated as possible foci influencing the disease, although their positive relation was not clear, except in one or two instances. When treatment by drugs or other means is instituted before time enough has elapsed to note what improvement is afforded by the removal of foci, it is obviously difficult to award the credit which may be due to either measure. A study of the stools for parasites and examinations of bacterial flora have not produced evidence which has directed treatment of the bowel. Colonic flushes have been employed, however, rather empirically. Iron, cacodylate of soda, strychnin, and tonic drugs were used almost continuously, and they apparently assisted in maintaining health by improving the blood, so that discomfort was materially relieved. Arsenic in the form of cacodylate of soda was most often used. Blaud's pill was the form of iron used. The salicylates, so useful in relieving pain in acute rheumatic fever and in many other conditions, are of no service. In fact, this observation has led to its use as a therapeutic test. Atophan (cinchophen) and pyramidon are more useful, but of limited value. They relieve pain somewhat, but continued over long periods are apt to interfere seriously with digestion. Iodin and its salts have been used for many years in the treatment of arthritis with indifferent success. Oxyliodid was more beneficial than those just mentioned. It has been noted that sodium iodid is very useful. We have employed this drug many times, in the form of an aqueous solution, each

cubic centimeter representing 2 gm. of sodium iodid. We gave the drug in doses of 15 to 20 c.c. intravenously on every second day as long as there were indications for its use. There were no severe reactions produced in any of our cases, and in nearly every instance a rather marked abatement of symptoms and relief of pain followed. This drug seemed to be of greater service than anything we had ever used until the introduction of iodoxy-benzoic acid derivatives. The ammonium salt, a crystalline product, synthetically prepared, and easily soluble in water has been found to be the most useful. In fact, this drug has added more to the satisfactory therapeutic attacks against chronic arthritis of all sorts, than anything else we have ever employed. The intravenous form of administration has been the one of choice, where possible, because of the greater relief due to more positive action.

The standard dose is 1 gm. dissolved in 100 c.c. of sterile distilled water, given every three or four days. It is given by the gravity method, and it is not permitted to run in rapidly, because of the likelihood of producing reactions. The reaction is characterized by smarting of the eyes, mouth, and nostrils at first, and later a more or less severe group of symptoms at the end of a half-hour to two or three hours. There may be malaise and nausea and more often the reaction is marked by a chill, vomiting, and purging, and the temperature may rise 1° to 4° F. There seems to be no way to forecast the cases in which a reaction may occur. A reaction does not seem to make the relief more marked. For patients in whom the intravenous method is difficult or impossible on account of lack of easily accessible veins the drug has been given by mouth or rectum. This method requires larger doses, and the chances of benefit are not as great. However, as a supplemental means or when the intravenous administration is not possible, it should not be omitted. For oral use, 5 gm. for several doses with plenty of water three or four hours apart upon a fasting stomach has been most effective. We have not used the drug rectally, but it has been used by a number of clinicians with good effect.

In the cases treated by us, the use of this drug has been

followed by definite improvement. Actual joint changes have not disappeared, but in most instances pain has been relieved, swelling has disappeared, and actual improvement in joint function has been seen. Some of our patients who were unable to close the fists, move the wrists and elbows in dressing themselves or in feeding themselves, were able to accomplish these acts after the use of the drug. It has an action which is based upon its germicidal effects and upon its apparent ability to stimulate the defenses of the body in general. Where permanent anatomic changes have developed improvement in function should not be expected after its use. The pain can be markedly lessened and proper orthopedic procedures are definitely indicated. The most active of our cases have responded best to this form of treatment.

Elimination is indispensible to assist in ridding the body of toxins. Free action of the bowels should be maintained without vigorous purgation and depletion. Colonic flushes have been used for this purpose. Water should be taken freely. Free diaphoresis by the use of baths, electric pads, cabinets, therapeutic lamps, and other apparatus is of decided benefit if regularly and persistently employed, but not to the point of exhaustion.

The diet should be ample and well balanced. The patients are generally under-nourished, and some do not seem to have the ability to handle carbohydrates normally, but it is seldom necessary to restrict to the point of a light diet. In the case of heavy eaters, reduction is of course advisable. Carbohydrates and proteins should be administered with the patients' well being as a guide.

Vaccines have been used in the treatment of many cases. After the search for foci has been concluded, theoretically it is desirable to employ as specific a product as possible and, therefore, if a reliable autogenous vaccine is available it has been used. The obscurity of the benefit conferred, in the case of relief suggests that there is little of specific nature to expect. Allergic reactions, protein shock, and allied phenomena associated with chills, fever, and headache, following the introduction of certain substances into the blood-stream have ap-

parently relieved pain, and their use has been justified on this basis. Stock vaccines, typhoid bacilli, and foreign proteins including horse-serum, antimeningococcic serum, bacterial filtrates, and milk in the form of aolan have been used with good results. The dosage is entirely dependent upon the reactions produced by the condition of the patient, and duration and extent of the disease. No general rules may be laid down, but most patients seem to experience greater relief when there has been a reaction. Susceptibility varies so greatly that each case must be a separate study. In the case of autogenous vaccines we have used from 2 to 3 c.c. of the product subcutaneously twice a week. Where the foreign protein shock was obtained, 1 or more c.c. of the substance were injected intravenously with one- or two-day intervals.

Local therapy has an important rôle in the treatment of this disease. No other adjunct seems to be more satisfying to the patient. With the advent of improved methods in physiotherapy much of additional helpfulness will be added to the treatment of patients. Heat acts as a marked sedative and analgesic. By the production of hyperemia and by hastening blood-movement, stasis in the vessels is relieved. Nerve irritability and pain seems to be materially lessened. Luminous heat waves and shorter impaired rays in the upper region of the spectrum penetrate more deeply and are most effective. Carbon lamps capable of emitting suitable rays, with good penetration are now available, and inexpensive for use in the home as well as in institutions and hospitals. Heat rays from ordinary incandescent lamps produce quite intense heat and have a good penetrating power. It has been our custom to use some good emollient upon the skin whenever heat has been repeatedly applied. Medicinal applications such as counterirritants give subjective and temporary relief, but are not equal to heat in their effects, and have the disadvantage of being greasy, having an odor and the likelihood of irritating the skin. Massage, including passive and active motion, has been of inestimable value in the cases treated in this clinic. Some clinicians hold the view that further irritation in an already inflamed joint should be avoided. However,

we feel that much damage is done by the all too frequent practice of immobilizing joints and allowing casts to remain for long periods, thus increasing the fibrositis, shortening tendons, and producing an atrophy of the muscles from disuse. After the initial stage of the disease where rest and immobilization are clearly indicated all efforts to preserve motion, muscular tone, and joint-function are to be diligently pursued. With the many means of relieving pain, it is often possible to institute the early movements and massages of the joints. The movement of a joint is, perhaps, more dependent upon the ability of the muscles controlling it to act, than it is upon a perfectly functioning articular structure. Massage may take the place of exercise in cases where much volitional or passive motion is not to be had. It improves the muscular and systemic metabolism. Many ingenious mechanical devices have been manufactured by and for physicians interested in these diseases and their progressive treatment. These have been used to promote passive motion, and in suitable cases have done a great deal to promote activity of the circulation and to keep the joints movable. Forcible breaking up of a stiffened joint, unless for the purpose of ankylosing in a more favorable position is to be deplored. We have seen no benefit and much damage in such cases.

Rest following periods of activity, if not carried to the point of adding to muscle atrophy, is highly beneficial. Patients suffering from chronic infectious arthritis invariably do better in warm, dry temperature than in locations where the changes in weather are abrupt and where there is much heat, cold, and humidity. Outdoor air is of advantage when possible. In the use of electricity, the thermic effects of high-frequency currents are probably the most marked among the sources of electrical energy. The physiologic effect of this heat upon the tissues is derived from the increase in blood-supply. This hyperemia has a tendency to persist with its beneficial effects for a long time. We have found this therapy a useful adjunct in improving the circulation, the metabolism, and the elimination of toxic products which may have been promoting or aggravating the condition. The growth of germs may be restricted and increased circulation

may assist in removing some infiltration from the joints. We have had no experience with radium or radio-active waters.

Summary.—1. Chronic infectious arthritis is a disease which, if neglected, has serious and chronic complications.

2. Many of these may be prevented by treatment instituted early.

3. Careful and persistent search for foci of infection early in the disease is most important.

4. It is a disease of early adult life, and infectious in character.

5. Much relief may be afforded by persistently employing the measures suggested.

CLINIC OF DR. H. B. HAMILTON

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THE UNDERNOURISHED CHILD, WITH CASE REPORT

THIS little girl was sent in four days ago because of her malnourished condition. She is thirteen years old. The mother states that she has always been undernourished. The delivery was without incident, and for three months she was a breast-fed baby. As a younger child she was fairly active, but always under normal weight. In school she got along fairly well. Some time ago she associated intimately with a girl who had tuberculosis. Two years ago she developed influenza and for three weeks was sick, running a high temperature. Following this she did not appear to be well, lacked appetite, did not get along so well in school, and was quite underweight. She was seen by a visiting nurse and referred to the dispensary. She had a tonsillectomy and adenoidectomy performed on June 28, 1927, but was returned to the dispensary later. Repeated urinary examinations there showed the presence of albumin (1–2 plus) with a few pus-cells.

In June, 1927 she was sent to the Elk's Kiddie Camp, where she remained three days, and gained 1 pound in weight. October 8, 1927 she had a pulse of 150 and a 2 plus albumin, an enlarged thyroid, and pulsating vessels in the neck. On October 8th the urine was 2 plus albumin, pus-cells 1 plus. On the 15th she had a temperature of 98.4° F. The reaction of the urine was alkaline. Tests for acetone, diacetic acid, and sugar were negative, and microscopic examination was likewise negative. On October 19th she had an albumin of 2 plus.

Physical Examination.—As one examines her lying in bed it is evident that she is a tall child. The thorax is long and thin,

the ribs are apparent, expansion is equal. On auscultation there is possibly a slight dulness and slightly higher pitched respiratory note in the right apex. There are no râles. Physical examination of the chest does not furnish any definite evidence of lung pathology. She has no tremor. She shows no evidence of exophthalmos, but she has an enlarged thyroid. Her basal metabolic rate, however, is 14 per cent. She also shows pronounced lordosis, dorsal curves, and rather prominent abdomen, with the greatest part of the enlargement low down. She slumps after she has been sitting for a while. Her weight is 60 pounds and, comparing that with the usual standards, she is 24 pounds below normal.

Laboratory Findings.—The urine has a specific gravity of 1.023. The red blood-cell count was 5,100,000; hemoglobin, 76 per cent.; the white blood-cell count was 9200; polymorphonuclears, 62 per cent.; lymphocytes, 35 per cent.; non-protein nitrogen, 38 mg.; creatinin, 1.3 mg.

I asked that the urine should be examined twice a day—before she got up in the morning and after she had been about. The morning specimen showed an entire absence of albumin, while the later specimen showed 1 plus. I believe the albuminuria has no significance and is to be regarded as an orthostatic albuminuria which may be due to exercise and to the lack of support of fatty tissue by the kidney. Such a condition we see rather commonly. Here is the *x*-ray of her chest.

Dr. Peirce: The most striking thing about the *x*-ray is the long thorax. Another feature of the case is the marked underdevelopment of the fore part of the humerus on both sides. It is a very striking appearance, but rather common in this type of patient. The diaphragm seems to be fairly normal on each side. There is no evidence of effusion. The heart is of the vertical type. The hilum markings are accentuated with an enlargement of the hilum glands over the left auricle. There are several areas of calcium deposit ranged in a group of more or less mulberry masses between the middle and lower lobes on the right side. This type of tuberculous infection we call the productive type, and it is probably of bovine origin.

DR. HAMILTON: The von Pirquet test is, as you see, perhaps $1\frac{1}{2}$ by $1\frac{1}{2}$ cm. The Wassermann is negative. Notice how she slumps as she sits up. She is easily fatigued; she is at the age when active tuberculosis is not infrequently found. Since she has been in the hospital her temperature has ranged from 97° F. in the morning to 101° F. in the evening, and the pulse varied from 84 to 128. The underweight, the fatigue, the enlarged thyroid, the rapid pulse would suggest hyperthyroidism, but she has no tremor, no exophthalmos, and a 14 per cent. metabolic rate.

The pyuria and albuminuria would be suggestive of a kidney lesion, but the pus-cells in the urine are not sufficiently numerous to justify a diagnosis of pyelitis, and the albuminuria is present only after exercise, and since she has been at rest there are only a few pus-cells in the urine. Neither the white blood-count (9200 per c.mm.) nor the differential count (with 62 per cent. polymorphonuclears) would point to an ordinary acute infection. Nor would a red blood-count of 5,100,000, and a hemoglobin of 76 per cent. point to an anemia.

The outstanding features in her case are these: *Underweight, exposure to tuberculosis at a susceptible age, rapid pulse, slight fever, fatigue, positive von Pirquet,* and *x-ray findings.* In spite of the generally negative chest findings, except for the *x*-ray findings, I believe that there is a sufficient basis on which to rest a diagnosis of tuberculosis. This child was sent to the hospital on account of her underweight. I have not seen other members of her family, and, so far as I know, they may all be of similar long and slender build. If this were the case, it might explain her failure to conform to recognized standards of age, height, and weight. Family and racial characteristics are closely related to this question. Other infections, such as diseased tonsils or infected sinuses as a result of adenoids, anemia, poor hygiene, bad feeding, and overfatigue, may all be factors. Especially the latter two are common causes of disturbed nutrition. At the present time there is propaganda on every hand to promote the drinking of milk. "A quart a day for every child" is the slogan. "A quart a day for some children" may be desirable, but "a quart a day for every child" is pernicious advice.

If a child is taking a large amount of milk and is constipated or anemic, or has a poor appetite, less milk and more other food in the diet will benefit him. Of course there is always the problem to be considered of the child eating too much candy, and particularly of the wilful and spoiled child of indulgent parents, who will eat only what he wants instead of what he should. Naturally his appetite impels him to select such articles of diet which gradually lead to the development of a badly nourished condition, with an exaggerated tendency to infection, which, in turn, impoverishes his nutrition still further. Then there is the problem of fatigue as the result of keeping late hours, going to movies, or playing with older children, who set too fast a pace for the weaker child. Dancing and music lessons and other efforts in addition to regular school work allow the little patient time neither for rest nor for play, and these factors should also be taken into consideration by the doctor. Ambitious parents stimulate the mental activities of these children beyond their strength in order that they may excel in school. All of these things react unfavorably on the child's nutrition.

I want to say that I am not invariably impressed with height and weight standards. This child is above height for her age, and I believe children of this type cannot be expected to conform to a rigid standardization. If you put additional weight on this tall child with muscles and bones which are long and immature, she will not have the endurance which a lighter child has. Every pound underweight in an adult, so long as he is physically well, according to insurance statistics increases his expectancy of life. I am not in sympathy with the idea of forcing every one to a certain standard, which itself represents an average. If a child can exercise physically and mentally, and does not show marked evidence of fatigue, a few pounds underweight is of no importance. Endurance is a more important factor than weight. Occasionally a mother comes to the doctor with a very fine set of papers where she has figured out the calories which her child is getting. I invariably expect a poor specimen when the mother treats the child too scientifically, and am rarely disappointed. Then there is another group, represented by a child a little under-

weight, and a mother who feels that she has failed toward her child and is now faithfully trying to follow current propaganda. I examined recently a child who ate poorly, was peevish, underweight, constipated, and had night tremors. I went over the child and found indications of no infection. The mother was very much concerned about him. He was playing with an older child and was fatigued. This child was constipated because he was forced to drink a quart of milk every day. I reduced this by a good deal. Milk is not a necessary food. There is frequently more harm done by too much than by too little milk. Once in a long time I find a child drinking 3 quarts a day, and he is invariably a poor specimen. I directed this child be given a pint of milk a day, and that it be dropped entirely for a time if the constipation did not clear up. I gave him a laxative diet, advised more rest, and the result was entirely satisfactory. Aldrich, in his little book on "Cultivating the Appetite of Children," calls attention to the fact that fats delay emptying of the stomach. Large quantities of fluid with a low caloric value like milk make the child feel full and comfortable, and he does not care for other foods which are more nutritious. A most important thing to do for the child with poor appetite is to correct the diet. Then they must get more rest. If the child goes to bed at 8 o'clock and is still peevish in the morning, he should have another hour or two of sleep at night. Medicine usually does not do them any good. Laxatives do not usually help. I give cod-liver oil which sometimes increases the appetite, but on other occasions causes its loss. Fats are slow in leaving the stomach, and consequently delay the onset of hunger pains, and naturally the appetite is diminished.

I had a baby in my office yesterday whose mother complained that he would not eat. We see dozens of these cases. The mother said she used all sorts of ways to induce the child to eat, telling him stories, etc. His meals were a family affair, with the whole family trying to get him to eat. A child is like an adult in the respect that he does not want to do the things that other people want to make him do. He should be taken off by himself and he is likely to regain his appetite. We must, of course, exclude

all possibility of infection, congenital malformations, and errors in diet and overfatigue. Children who are kept up late at night, or are playing with older children, suffer in their nutrition as well as in their disposition.

DR. PRATT: What about the faulty posture? Would you do anything about it?

DR. HAMILTON: I do not think so. In the well child it is well to give him a turning pole or Indian clubs, but do not keep nagging at him. Children are nagged too much. That also makes food repulsive to them. I do not believe there is much use in paying attention to the posture. If we can correct the underlying conditions the posture will take care of itself.

Allow me to summarize what I have been trying to say about the underweight older child.

1. So-called "standards" of weight and height and age are of value, but they do not necessarily reflect a true index of a child's nutritive condition.

2. Much propaganda which is put out by various organizations—newspapers, magazines, and untrained or semitrained persons—is misguiding and harmful.

3. Infections must be eradicated if undernutrition is to be successfully managed.

4. Not infrequently the overconsumption of milk is a disturbing factor in the child who is otherwise well, but underweight.

5. Nothing short of a careful history and a thorough physical examination of the child can form an adequate basis for intelligent treatment. This cannot be done wholesale.

6. Endurance, the ability to undergo physical or mental activity without illness, peevishness, or excessive fatigue, is a better criterion of "fitness" than the mere relation of age, height, and weight.

ABDOMINAL PAIN IN CHILDREN WITH UPPER RESPIRATORY INFECTION

DR. PILLSBURY: This boy is nearly nine years old and was brought in complaining of pain in the epigastrium and vomiting. He was running a high temperature. On Tuesday at 3 o'clock in the morning he was attacked very suddenly with pain in the abdomen which was more or less generalized, described as around the umbilicus. He vomited for two days and the pain localized more in the epigastrium. He was brought into the hospital on the third day. He had constant pain and vomited frequently. When he entered his temperature was 104° F., pulse 128, respiration 32. He had a white blood-cell count of 17,000 (polymorphonuclears 83 per cent.; lymphocytes, 15 per cent.) and a 1 plus albumin in the urine.

DR. HAMILTON: Some of you have seen this patient. He was sent in with a diagnosis of acute appendicitis and was admitted to the surgical service. For three days he had abdominal pain and vomiting, which began rather suddenly. The surgeons who saw him did not think he was an operative case, and referred him to the pediatric service.

Physical Examination.—He is a well-nourished boy, rather tall, and now he is resting comfortably in bed. On admission to the hospital he looked ill. His abdomen was not much distended, nor was there much abdominal tenderness. He complained mostly of pain in the right hypochondriac region, but had only slight tenderness. His throat was red, swollen, edematous, with whitish spots dotting the tonsils. The pharynx was distinctly red and granular, Both ear drums were reddened and slightly tender to pressure. The chest findings were negative at that time and he had a normal pulse respiration ratio. On the third day after entrance to the hospital his respiration rate was 40, pulse 100, temperature 105° F. On the morning of the seventh day the temperature dropped by crisis and has remained normal since that time. Physical signs that morning

showed a very definite pneumonia of the middle lobe of the right lung. The evening before, upon a very careful examination, no such findings were evident. The *x*-ray plate speaks for itself.

DR. PEIRCE: We have seen quite a few of these lobar pneumonia cases in the last few days. This youngster is beginning to clear a bit in the periphery. We notice that there is no demonstrable effusion. We cannot demonstrate any effusion in the base in most of these cases. Why is it that there is not enough pleural reaction to get some effusion?

DR. HAMILTON: It might be possible that the infection does not always penetrate sufficiently deep into the pleura. The pain in this instance began about the umbilicus and later was referred to the right upper abdomen. I presume his pneumonia had something to do with the location of his pain.

DR. KEEGAN: How do you explain the reflex?

DR. HAMILTON: The same mechanism which functions in "Head's zones" may be a factor. When the diaphragmatic pleura is involved it is not so difficult to account for pain in the abdomen. When the pneumonic process is high in the lung it is more difficult to explain, but when the upper respiratory tract only is involved no satisfactory explanation has been offered for the reflex. Brennemann has probably written more than any other concerning the latter phase of this condition. He has presented some evidence that the pain is caused by swelling and sometimes by inflammation of the mesenteric lymph-glands. I have wondered if the intestinal musculature is not in some way linked up with this pain in acute upper respiratory infection. We all know how the general musculature of the body aches and hurts with a grippal infection. Why not the intestinal musculature as well? I am sure this is the most common abdominal pain the pediatrician sees. If the abdomen is tender at all it is generally a diffuse tenderness, while the pain is more likely to be located about the umbilicus. The pain is much more marked than the tenderness, contrary to the findings when there is an intra-abdominal inflammation, *e. g.*, appendicitis or an actual lymphangitis. The pain is usually relieved by the repeated application of hot compresses.

There is one other symptom presented by the patient of which I wish to speak. He vomited persistently for three days. If abdominal pain is common in respiratory infections in children, vomiting is well nigh universal. Here again the exact mechanics of a symptom in its inception may be difficult to explain. The continuation of the vomiting for two to five days is frequently less dependent on the disease than it is on the measures used for relief. If any other organ in the body was subjected to insults comparable to those which the stomach suffers in well meant efforts to stop vomiting, there would be rebellion of function just as promptly. Frequent giving of food and drink, cathartics, and other nauseating drugs to the struggling owner of a disturbed stomach cannot do otherwise than defeat the purpose for which they were intended.

DR. MILLER: Is the vomitus ever bloody?

DR. HAMILTON: I have seen it bloody and many times black. They will be continually vomiting, and you will find that in some of them a test for occult blood is positive. When this occurs, severe toxemia and dehydration are present, and the danger point is approaching.

DR. MILLER: Hemorrhage into the mucosa of the gastro-intestinal tract is a common finding in death from infections no matter where located. It seems to be the result of degeneration caused by toxemias in these tissues. The mucosa tissue is apparently more susceptible than other tissues to this effect.

DR. HAMILTON: There are also some of them associated with petechiæ in the skin, and in such an instance the result must be looked upon with apprehension. Since this boy came to the hospital I have had 2 other similar cases. One vomited three days except during the night. I am sure that this was due to the fact that this patient did not take any food or drink at night. Another had vomited two days. The same line of treatment relieved promptly both of these cases. Now, the point I wish to stress is not the fact that the patient has lobar pneumonia with delayed physical findings. This is common enough. Abdominal pain with acute pulmonary involvement is also quite common. It is perhaps not so generally recognized. Abdominal pain asso-

ciated with vomiting occurs frequently with upper respiratory infections. Both pain and vomiting are ameliorated by the application of a moist abdominal compress. The period of vomiting can be cut short by the prompt and absolute withdrawal of food and drink for a time. No drugs should be administered, but a piece of cracked ice or a teaspoonful of weak tea should be given every few minutes. An abdominal compress should be applied in the following manner: A towel is wrung out of hot water and placed on the abdomen. This is covered with waxed paper, and over this a light hot-water bottle is placed. This compress should remain for about forty minutes, and should be repeated about every four hours. Occasionally an enema is also valuable. Whatever factor may have the beneficial effect, it is certainly gratifying to see how often this treatment is successful. This patient has not vomited since the treatment was instituted, nor did those other two patients mentioned a moment ago. A little later iced sweetened orange juice may be given. Gradually the patient is returned to a more liberal diet, but milk should be withheld for a while. An enema may assist in starting normal peristalsis. It is good practice to allow the child some chewing gum which he likes, instead of drugs which he dislikes.

CLINIC OF DR. C. W. M. POYNTER

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CONCERNING THE GREAT OMENTUM

THE great omentum was known in the days of Herophilus, and ever since abdominal operations have become a commonplace it has occupied a position of interest. It has been dignified as an "organ" and has been dramatized as "the policeman of the belly." Nature has shown us that it can plug a hole in the stomach and radical surgery has proved that it is not indispensable to individual well being. Each year adds many new titles to the voluminous literature concerning it without defining its status in the body's organization.

The frequency with which neoplasms and inflammatory processes are encountered in conjunction with the omentum leaves no doubt that it is an important structure from a pathologic standpoint, but its function in health has never been clearly defined. It seems worthwhile to review our present knowledge of its structure and development, and to examine its reaction under certain experimental conditions in order to discover what part it has in the physiologic processes of the body.

The great omentum (omentum majus) appears first as the mesentery of the stomach (dorsal mesogaster), and at this early stage presents no structural characteristics to differentiate it from the mesentery of the small intestines. It consists of two lamina of mesothelium with a greater or lesser amount of connective tissue between, and in the latter the blood-vessels ramify. This early condition, about six weeks, is soon changed. The classic description associates the change with the rotation of the stomach, but it is probable that the great omentum possesses a growth center of its own which enables it to develop, partially

at least, independently of the stomach movements. With the formation of the lesser sac its floor is extended downward to form a broad fold of mesogaster lying in front of the transverse colon and the small intestines. By the time of birth, or shortly thereafter, certain adhesions occur, namely, the dorsal surface of the mesogaster is adherent to the transverse mesocolon and the transverse colon; the surfaces of the mesogaster in contact with each other, as the result of the folding, adhere, creating the adult condition. The portion of the mesogaster extending caudally from the transverse colon constitutes the great omentum.

While the growth just outlined has been taking place histologic changes have also occurred. The areas along the course of the blood-vessels have thickened by the deposit of fat between the mesothelial layers and masses of lymphoid cells, taches laiteuses, have developed. Shortly before birth the areas of the membrane between the blood-vessels are beautifully gossamer-like in their thinness and transparency. Shortly after birth these areas become perforated by many holes, so that the German name "Netzes" can be very appropriately applied to the omentum.

During the period of childhood the great omentum continues to grow downward and a great amount of fat is deposited. The structure becomes very vascular and it is interesting to note that the venous radicles increase proportionately more than the arteries. Reviewing the development, we see the mesogaster beginning as a supporting ligament for the stomach, but through overgrowth and change of position ceasing to function in that capacity and undergoing structural changes suggesting in some respects degeneration, and in others, specialization of function.

A study of dissecting-room material brings out a number of definite facts. To begin with, the opposing mesothelial surfaces do not always adhere. Notes which I made on 200 bodies show 5 per cent. in which no fusion occurred and, as a result, the lesser sac extended to the caudal limit of the omental fold. Another 10 per cent. of bodies showed only partial adhesion, and in several of these the layers could be separated throughout their extent

with very little force. I found no case in which the omentum was not adherent to the transverse mesocolon.

I agree with Lockwood that the omentum tends to extend lower as age advances, and the number of cases in which it reaches below the symphysis is much greater after fifty than before. The lateral development also shows a variability, but this is not related to age. Occasionally the right border begins well over on the duodenum and extends directly downward, forming a quadrilateral structure reaching into both iliac regions, but in most cases there is lack of development of what might be designated as the right lower corner; the structure is then not bilaterally symmetric, but lies more to the left, and this explains why the omentum is more frequently found in a left hernial sac than in a right.

It is impossible to determine the normal position of the omentum, as, for instance, in the standing position. An examination of four bodies where death had occurred suddenly while standing all showed the omentum more or less drawn up and buried among loops of intestines; in one the omentum was tucked up under the liver well to the right of the stomach. In one electrocuted individual the omentum was massed on the gastrocolic omentum, and against the greater curvature of the stomach, while in another it was spread out over the small intestines and the descending colon. In none of these cases were there any adhesions; of course it cannot be stated positively that the "death struggle" did not disturb the normal position of the structure. The above referred to series of cadavers showed 10 per cent. only in which the omentum was reasonably well spread out over the intestines. From the various positions in which it was noted it seems reasonable to assume that it is carried about by the forces of respiration and intestinal movement. At least a study of its structure makes it possible to say positively that it is not capable of intrinsic movements of any considerable or purposive extent.

We have seen that fat is deposited in the omentum before birth and increases markedly in amount during the first few years of childhood. The amount of fat in any individual case

bears a close relation to the general fat-depositing tendencies for the body, and, as in exhausting diseases, it loses its fat as the body becomes emaciated, the last to disappear being that along the blood-vessels.

Histologically the omentum does not support the generally made statement that it is covered with peritoneum; we must at least say that the peritoneum has been modified. When treated by silver to bring out the cell boundaries a pavement mesothelium can be seen over the opaque areas carrying the blood-vessels, but in the spaces between, where the perforations occur, this typical cellular structure disappears. The reticulum is made up of strands of cytoplasm carrying a few elastic fibers and scantily supplied with nuclei. It may be considered a syncytial network markedly eosinophile in reaction and almost unvascularized. In the child at birth there are lymph-channels found in relation to the blood-vessels, but these soon degenerate and by the third year they have all disappeared. The lymphatics begin to develop about the 20 cm. stage, but from their irregular development and appearance it seems to me doubtful that they ever function as a drainage system for the structure.

A consideration of the structure and development of the great omentum indicates that it must have some important function, but while many uses have been suggested, most of these are passive and may belong equally to any similar movable peritoneal surface. The fact that the surgeon uses it to cover an area denuded of peritoneum or to prevent adhesion of the intestines to wounds of the abdominal wall can hardly be interpreted as a function. I have already called attention to its variable position which, in this connection, would seem to minimize its function as a thermal or mechanical protection for the intestines. There is much experimental evidence to show that, under the influence of mechanical, chemical, or thermal irritation its blood-vessels readily dilate, and it has been estimated that its dilated vessels may be made to contain as much as one-fourth of the total blood. This reaction even when quantitatively interpreted does not constitute proof of function and, moreover, its nervous structure hardly suggests the possibility of such a regulatory mechanism as the

idea implies. The omentum is frequently found as one wall of a circumscribed inflammatory process in the peritoneal cavity, but other peritoneal surfaces form the other walls, and we are forced to conclude are equally active in the process. It seems almost unnecessary to speak of the suggestion that its cell aggregates, taches laiteuse, are the seat of antibody formation not only in view of our present confused ideas on the action of cells of this class, but also because the place of antibody formation seems to be as obscure to our generation as the seat of the soul was to our ancestors.

Experimental work seems, as yet, to offer the only method for the solution of the problem of omental function. As the result of certain experiments carried out for another purpose I have made some observations on the reactions of the omentum which are interesting and suggestive. When the omentum is irritated in various ways it reacts as do other peritoneal surfaces in wound healing, formation of adhesions, inflammation, etc., but by the use of inert materials and solutions it can be shown that it reacts differently from other peritoneal surfaces. I can illustrate by summarizing certain experiments which have been recently made. Interperitoneal injections of inert masses like India ink, carborundum, ultramarine blue, as well as certain crystalloid dye solutions, were made in various laboratory animals and the results examined at various intervals. When the animal was killed five minutes after injection it was possible to wash off all peritoneal surfaces except the omenta, which remained deeply stained. Microscopic examination showed that the dye particles were held to the surface by a coagulum. Treating the peritoneum of a freshly killed animal with silver solution did not show that the omentum possessed a much greater amount of coagulum than other peritoneal surfaces, from which it may be concluded that the injection caused the omenta to react specifically.

When the experiment was extended over several hours not only was the amount of dye on the surface increased, but the coagulum was greater in amount and many small round cells were scattered throughout the mass. As the reaction proceeded

the body of the omentum became thicker and the blood-vessels dilated, the mesothelial boundaries disappeared where they were in contact with the coagulum, and the dye was transported through the intercellular spaces toward the blood-vessels.

An examination of this process frequently during a period of two or three weeks shows that it is progressive. More and more of the dye is taken up, enters the small blood-vessels, and is carried by the portal vein to the liver. The cells in the coagulum increase in number and soon several types can be recognized. The small round cells are not a part of the scanty fluid contents of the peritoneal cavity at the time of the experiment; it seems quite certain that they have not come from the blood-stream; perhaps we can call them endotheliocytes; later macrophages, polymorphonuclear leukocytes, and lymphocytes are present. For our purpose at this time it is not necessary to analyze the possible sources of these cells and it is perhaps sufficiently explanatory to say that the process is that of an inflammatory reaction. After a longer or shorter time, depending to some extent on the size of the injection, resolution is complete and the omentum again appears normal.

Since it has been so frequently suggested that phagocytosis plays a large part in peritoneal absorption it is interesting to observe the reaction to particles so large that this process is out of the question. For this purpose lycopodium spores were injected interperitoneally. These are caught up by the omentum and held just like the smaller dye particles, but it is surprising to find that they also pass through the mesothelium and enter the deeper structure. Apparently their size prevents them from being taken up by the circulation. Direct observation of the omentum during the process of taking up particles fails to furnish much information. The particles pass through the mesothelial wall without regard to cell boundaries, at least in the case of the larger particles, and leave no evidence of their penetration. There is no histologic evidence of stomata or other cellular defects to account for the process. Crystalloids are rapidly taken up and have been recovered from the portal vein in a few minutes after injection.

Experiments like those just outlined place a strain on the omentum far beyond the normal requirements and, consequently, caution must be used in making interpretations. At least the experiments have shown us that the omenta act differently from other peritoneal surfaces, and, indeed, from other mesenteries; through them particulate matter and solutions are taken up from the peritoneal cavity and enter the blood-stream. There seems to be little doubt that bacteria and toxins are taken up in the same way.

Under certain circumstances the general peritoneum acts as an absorption membrane, but under normal physiologic conditions the omentum is the avenue through which the peritoneal contents reach the blood-stream most directly.

I do not mean by this discussion to imply that the great omentum has, at last, been completely catalogued. The peritoneal cavity is not normally filled with a circulating fluid, as, for instance, the cerebrospinal fluid, consequently there seems to be little reason for so elaborate a structure if absorption is its only function; moreover, the pleural cavity is also a serous sac and functions without a structure comparable to the omentum. It is interesting to think that a structure so long known, so large, and so thoroughly studied should be so little understood.

CLINIC OF DR. CARLETON BARNHART PEIRCE

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PERFORATION OF THE SMALL BOWEL

THE three cases which we shall consider in our clinic this morning represent some phases of the abdominal emergency.

The Roentgen examination of the abdomen most often taxes the ingenuity of the observer; first, because of the relatively homogeneous density of the abdominal viscera in their natural state; and second, by the necessity, therefore, of dependance upon the production of a silhouette of these viscera, either of the lumen, or of the mass of the organ, for visualization. This may be accomplished by the introduction of a contrast medium such as barium sulphate, the inflation of the hollow viscus by gas or air, or the outlining of the several separate masses by free gas in the peritoneal cavity. The last may be induced either by the spontaneous extravasation from a perforated bowel or by an artificial pneumoperitoneum. In the case of the abdominal emergency, further, it is limited by the inadvisability of manipulation of the patient beyond the minimal necessary movement. This in general, therefore, would preclude the examination in the prone and erect positions as ordinarily is done. Further, if there is intestinal perforation or obstruction, it would be well to not use much, if any, of the contrast meal.

How then may the Roentgen ray be used in such cases to aid the process of diagnosis before operation? These several cases will illustrate some of the methods available.

Case I.—The first patient, Mr. N. N., aged sixty-four, laborer, thirteen days before admission had a heavy garage door topple over on him. He broke the fall of it with his outstretched hands, but was doubled up by the weight. He felt

"sick" at the time, but was able to get home without help. That night he drank a glass of milk, ate no food, and soon went to bed, complaining of pain in his "stomach." About 10 P. M. he doubled up in bed and began to moan. At this time he complained of a very severe pain high in the epigastrium and some shortness of breath. He did not vomit. An enema did not relieve his pain. The next morning he had a spontaneous normal stool. His chest findings are said to have indicated a pneumonia, and he was so treated by his home physician. As time went on the acute pain wore off. He could take nourishment in the form of a soft diet. He became, however, progressively weaker and developed a productive cough. The day before admission he had developed a marked distention of the epigastrium with increase in his respiratory difficulty. At this time the home physician called Dr. C. R. Kennedy (from whose service these cases have been referred) in consultation.

The patient had had pneumonia five years previously with a persistent productive morning cough. His appetite had always been moderate. He had considerable eructation of gas after meals and occasional "heartburn."

On admission he was a markedly emaciated person of late middle life with a large and long bony framework. His respirations were rapid and shallow, ending in a grunt. The skin was dry, cheeks sunken, the tongue heavily coated. In short, he was definitely dehydrated. Expansion of the right chest was diminished as compared to the left. There was dulness to percussion over the area usually occupied by the right middle lobe, with tympany over the base; the left chest essentially normal. Moist râles were heard over the dull area. Heart-rate was rapid, without irregularity in sounds. The epigastrium and the right hypochondrium presented a marked bulge, extending from the xiphoid to just above the umbilicus. The rest of the abdomen was not rigid. Blood-count showed 4,450,000 red blood-cells; 10,100 white blood-cells (88 per cent. polymorphonuclears); 85 per cent. hemoglobin. Temperature 100.2° F., pulse 110, respirations 36. The introduction of a stomach-tube did not relieve the distention.

Case II.—The second patient, Mr. J. H., aged fifty-nine, farmer, on the day before admission, while going about his usual work at the barn, suffered a sudden sharp pain at the umbilicus. This was so severe that he doubled over and had great difficulty in getting to the house. The pain was knife-like and required several "hypos" by his home physician before any relief occurred. He did not vomit. During the night he was slightly nauseated and developed a slight headache. There was no bowel movement. No urinary disturbance was noted.

He had always been active, had never noted any distress after meals, or taken any soda habitually. Appetite was always good. So far as he could remember this was his first attack of severe abdominal pain. There had never been any urinary disturbances.

Examination on admission revealed a well-nourished, well-developed man complaining of severe abdominal pain, and breathing rapidly. There was no evidence of external injury. Chest expansion was equal on both sides. No irregularities in percussion or on auscultation were noted in either lung fields or heart. There was an increased rate of both respiration and heart action. The abdomen did not perceptibly move with respiration. There was much rigidity of the right hypochondrium with marked tenderness just beneath the right rib margin anteriorly. There was some tenderness in the right costovertebral angle. No masses were palpated, the left side of the abdomen was not rigid. Blood-count showed 13,800 white blood-cells, of which 92 per cent. were polymorphonuclears. Urine: Specific gravity 1.029, acid reaction, few pus-cells, no albumin. Temperature 100° F., pulse 105, respiration 35.

The two patients in common exhibit the following symptoms: Sudden, sharp, severe abdominal pain associated with a flexion attitude, some respiratory difficulty, and no demonstrable urinary signs of consequence. In the first there are said to have been definite changes in the chest, and he now shows evidence of some involvement in the right base, although peculiar in character. The first further shows a bulging area of tympany in the right hypochondrium; the second, a rigidity of the right hypochon-

drium. The blood-picture and temperature would indicate a relatively active infection.

Their history of sudden sharp doubling pain in the upper abdomen without direct trauma, and in the absence of any unusual urinary findings, would suggest for our differential diagnosis perforation of a gastric or duodenal ulcer, rupture of an appendix, acute cholecystitis, acute intestinal obstruction, acute pleuritis, or acute pancreatitis. The differentiation we shall assume as being made only from the Roentgen appearance. In perforation of an ulcer or of the bowel we would expect to find free gas in the abdomen; in rupture of the appendix this would not be so probable, in fact, rare. Very little further information as to the appendix could be suspected save with a barium meal demonstrating a spasticity, or permitting a localization of the pain point in reference to the bowel. This is impractical with these patients. Acute cholecystitis does not offer much assistance to the roentgenologist. Occasionally, with the refinements of technic available in the larger laboratories, a distended gall-bladder might be visualized. Nor does an acute pancreatitis aid one by hanging out a sign, save as a remote possibility, of sufficient enlargement to increase the arc of the duodenal loop if one should administer a barium meal. Here the same inadvisability applies as with the appendix. The acute intestinal obstruction, however, one should be able to detect with the collection of a greater or lesser amount of gas in the distended bowel, producing a silhouette of the fine valvulæ of the upper small bowel; and there may, further, be fluid levels observed in the distended loops. With pleuritis (possibly diaphragmatic) of such marked symptoms of pain and distress one would expect to find considerable fluid or increased pleural density.

If there has been a perforation with the extravasation of gas and alimentary contents the gas will seek the upper levels of the abdomen. When the "break through" has occurred into the lesser omental sac, and the foramen of Winslow is closed, it will be incarcerated there. However, provided the perforation has been anterior, or the foramen of Winslow is patent, the gas will be in the greater sac. The patient lying supine, it will be dis-

tributed along the anterior abdominal wall in the greater sac or along the gastrohepatic ligament or under surface of the liver in the lesser. Suppose the patient has his head and trunk elevated so that he rests in a semi-Fowler's position, or even more vertically (such as might be accomplished on a tilting fluoroscopic

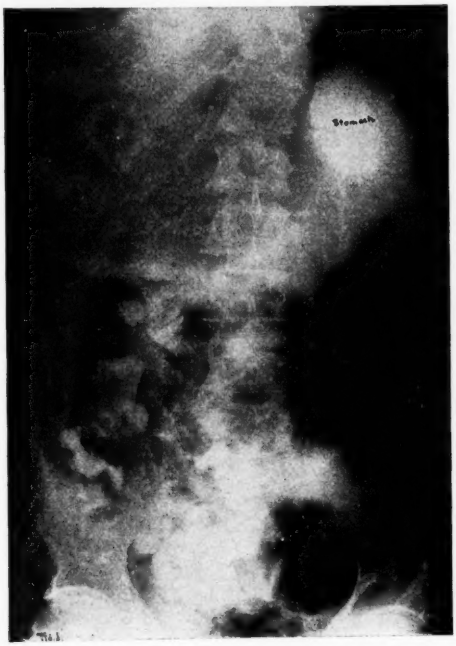

Fig. 86.—Mr. N. N., supine position. Note the area of lessened density to right of stomach shadow as indicated by the barium. Marked elevation of the right diaphragm.

table), the gas will, if free, accumulate beneath the leaves of the diaphragm on either side.

With an obstruction in the small intestine there should be visualized the loops of bowel distended by the accumulated gas and fluid. Supposing this has occurred and the patient is then elevated to a partial Fowler's position, there would be established

fluid levels in the distended loops with the gas distending the loop of gut above each fluid level.

One further possibility should be considered in our differential diagnosis, namely, subphrenic abscess. The organisms associated with the production of the subphrenic abscess are most commonly

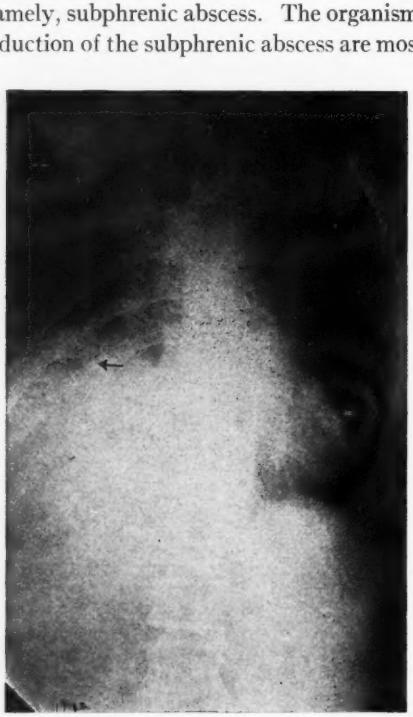

Fig. 87.—Mr. N. N. in semi-Fowler's position, showing marked elevation of right dome of diaphragm with thick diaphragmatic shadow and small amount of air immediately below the dome. Also some indication of the lessened density overlying the entire right hypochondrium.

of intestinal origin and are gas formers. Therefore, a subphrenic abscess should offer in the semi-erect position the radiolucency of gas or air overlying the level margin of an area of definite radio-opacity, the fluid of the abscess. Such a lesion, of course, might be a sequel of perforation.

The first patient's condition did not warrant much manipu-

lation. Examination under the fluoroscopic screen in the supine position revealed the fixation of a markedly elevated right dome of the diaphragm. An increased density of the lower half of the right lung field suggested a pneumonic process. In the right hypochondrium and apparently aiding in the displacement of the diaphragm upward was an area of diminished density (Fig. 86).

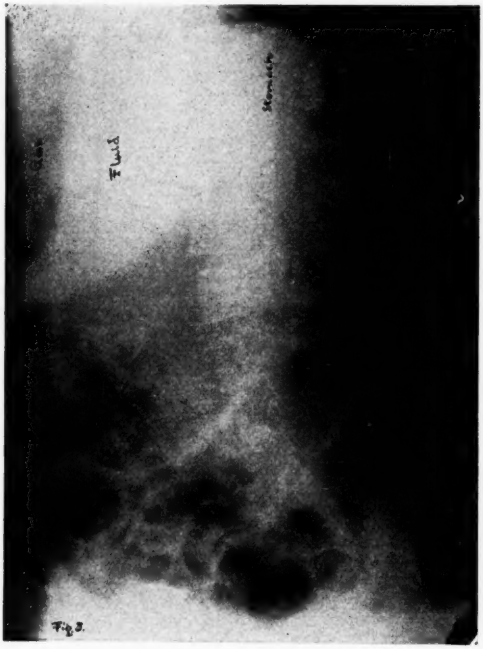

Fig. 88.—Mr. N. N. after opaque meal, patient lying on side, showing gas anterior to mass of liver and fluid, with stomach posterior.

Its contour suggested a very grossly dilated stomach. But the stomach was thought to be visualized by its retaining content pushed downward and to the left. The patient was given 2 ounces of the barium meal. The stomach was then shown definitely to be displaced as thought, and not forming a part of this less dense area overlying the liver shadow. In the semi-Fowler's

position we thought we could detect a fluid level and gas bubble beneath the right phrenic dome (Fig. 87). With the patient turned on his side one can readily distinguish the relative differences in density of fluid and gas in the area described (Fig. 88).

We may conclude that this is a patient with fluid and gas, apparently encapsulated, in a large area beneath the right

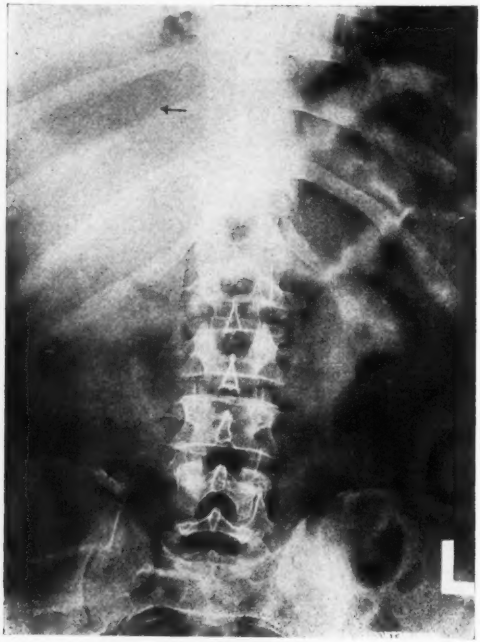

Fig. 89.—Mr. J. H., patient supine, showing a faintly visualized area of lessened density overlying liver shadow.

phrenic dome, overlying the liver shadow, and displacing the diaphragm upward. One would be inclined to the conclusion of a subphrenic abscess, due possibly to a perforation of the upper bowel at the time of the onset of the present illness.

Upon making a small midline incision, under local anes-

thesia, just beneath the ensiform, the surgeon was greeted at the peritoneum by a gush of foul-smelling gas and about 4 quarts of a thin muddy green, very foul, purulent fluid. A similar expulsion ensued with each inspiration, the patient's respiratory difficulty decreasing at once, and the abdominal distention disappearing. The wound was closed with drainage. Subsequent examination of the stomach has shown multiple scars in the prepylorus and duodenum; one on the anterior wall of the bulb more recent than the rest. The abscess cavity was limited by the falciform ligament, the parietal and visceral peritoneum in the prehepatic space, and the lesser and greater omentum.

One film was made of the second patient to check as to the possibility of a renal calculus. He was too ill to be studied to any extent. On this film (Fig. 89) there will be noted an ovoid area of lessened density overlying the hepatic shadow on the right. There is no evident free subphrenic gas. This would suggest some accumulation of free gas in the peritoneal cavity, most probably due to a perforated upper bowel. Further conclusions could not be drawn.

With the provisional diagnosis of perforated ulcer a laparotomy ensued nineteen hours after the onset of the pain. A large amount of free milky fluid was found in the peritoneal cavity with no appreciable amount of gas. On the anterior wall of the duodenal bulb there was a perforation about the size of a match head.

Case III.—The third patient, Mr. C. N., aged fifty, business man, presented a slightly different series of events leading up to his admission. Two days before, while at his club, he had run against the corner of the pool table, hurting himself in the lower abdomen. He had some pain at the time, but reached his home without assistance. There he fainted, and his physician was called. The patient's condition was not thought to be very serious. But the pain in the abdomen increased in severity, the abdomen began to distend, and no bowel movement could be induced by enemata.

Almost twenty-four hours after the injury (at the time ap-

parently trivial) he was admitted to the hospital. His chief complaint was pain in the lower abdomen, inability to move the bowels, and increasing distention. There was no history of previous illnesses obtained.

Examination revealed a well-nourished, well-developed man. His respirations and pulse were increased in rate, but no irregularities were demonstrable in the thoracic viscera. The abdomen was not board-like, but distended from the ensiform to the pubes. There was a slight bruise on the right side of the pubes just above the margin of the pelvis, and almost concealed by the pubic hair. There was a slight dulness in the flanks. Urine: Specific gravity 1.027, acid, slight amount of albumin, no casts, a few pus-cells on one field. Blood-count: 4,950,000 red blood-cells; white blood-cells on admission 4100, next morning 6700 (60 per cent. polymorphonuclears); hemoglobin, 90 per cent. Temperature, 100° F., pulse 120, respirations 25.

The patient presents in general the same sort of story, save that there has been introduced here a factor of direct abdominal trauma. Again the question of differentiation, chiefly of perforation of the upper bowel, or of the appendix, and subphrenic abscess is introduced. The pain is in the lower abdomen, there is a suggestion of fluid accumulation in the flanks, and a diffuse distention.

Upon the insistence of the patient's family and at the request of the consulting physician the patient was examined more thoroughly than the former cases.

The patient's condition was apparently fair. He was first fluoroscoped and filmed in the erect position (Figs. 90, 91). This revealed a marked accumulation of air beneath both leaves of the diaphragm, demonstrated by the crescentic areas of increased radiolucency beneath each diaphragm dome. Further, multiple horizontal levels of increased density surmounted by half-moon-shaped areas of lessened density, as of gas-inflated bowel, were seen all through the abdomen. This appearance was interpreted as free gas beneath the diaphragm, and a distention of the small bowel with an accumulation of fluid in the several oops. This last would suggest an obstruction of the lower small

bowel with probable perforation. These fluid levels were, of course, lost with the patient supine.

Confirming this preoperative diagnosis, a laparotomy revealed a rupture of the ileum 4 inches from the ileocecal valve. There were two small perforations as though the loop of gut had been pinched. Considerable exudate and free fluid lay in the

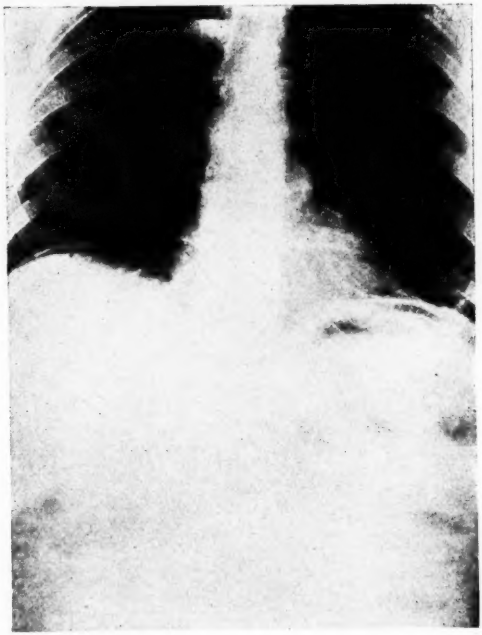

Fig. 90.—Mr. C. N., erect position showing crescentic areas of lessened density beneath each dome of the diaphragm and dilated loops of bowel in the abdominal shadow.

pelvis. The small bowel was distended and inflamed above this point, at which there was a definite obstruction. There was a generalized peritonitis.

These 3 cases demonstrate: First, a probable perforation of a duodenal ulcer in a patient with a history suggestive of previous gastro-intestinal distress. The terminal difficulty has

been possibly induced by the indirect trauma of sudden change in position and decrease in abdominal volume. The sequel has been the development of a subphrenic abscess. Second, a perforated duodenal ulcer without previous history. The predisposing changes and the mechanics of the perforation are not evident. There was but little liberation of gas into the peritoneal

Fig. 91.—Mr. C. N., showing the dilated loops of bowel with fluid levels in the abdomen; erect position.

space. But a sufficient amount is present to permit diagnostic deduction. Third, a perforation of the lower small bowel, apparently following upon direct trauma to the intestinal wall, with much extravasation of gas. Also obstruction in the lower portion of the small bowel with the accumulation of fluid and gas is shown by the multiple fluid levels.

All these cases were examined under the fluoroscope with a

minimum amount of manipulation. The conclusions in each have been drawn from the standpoint of the relationship of unusual areas of lessened and increased density in the shadow of the abdomen. The character of these shadows, relating to their density, contour, and distribution, is of considerable diagnostic value. Definite pertinent information is demonstrated as obtainable in this way, from the location of the areas of gas content, both without and within the bowel. Attention is again called to the fluid levels in obstruction as has been previously described by others. This may assist the surgeons in determining the point for incision, namely, for the upper small bowel or for the lower.

CLINIC OF DR. ROBERT D. SCHROCK

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CASES ILLUSTRATING THE VALUE OF ORTHOPEDIC MEASURES IN THE TREATMENT OF ARTHRITIS

IN the treatment of the acute arthritides which are accompanied by temperature, toxemia, and prostration, with the local manifestations of swelling and pain in joints, the attending physician's attention is too frequently centered on the general condition. He knows well that the local symptoms and signs will subside in due time after the febrile and toxic manifestations begin to clear. In addition to the general medication, local applications of salicylate preparations are used empirically both for the psychic effect upon the patient and in the hope of some local absorption. The pain is controlled by sedatives. Sedatives depress not only the sensorium, but the entire central and sympathetic nervous systems, thereby further deranging metabolic processes. In some acute cases sedatives may be necessary to make pain endurable. There are, however, certain fundamental principles which, if properly applied in the acute arthritides, will frequently decrease or obviate the necessity of opiates or sedatives, and will further make for a more satisfactory result. It is these methods which I will emphasize especially at this clinic.

The possessors of these acutely painful joints object strenuously to the motion or handling of their extremities. They demand immobility. They learn individually the relation between "rest and pain." Pain in arthritis is due to the inflammatory reaction with sensory nerve involvement and to muscular spasm. The spasm of muscle in the adjoining segments is a physiologic reaction, the natural protection against motion, productive of

pain. Relief of this muscle spasm is clearly indicated. This can be accomplished by fixation, splinting and traction, individually or, better, combined. In the non-articular cases adequate fixation is simple. The polyarticular type requires the exhibition of considerable ingenuity.

Adequate fixation demands that the patient be more comfortable and more easily cared for with the apparatus than without. The added requisites for this adjunct to the medical armamentarium are simplicity of apparatus, accessibility of the joints for local treatment, and absence of any source of disturbance of the circulation. Anyone well versed in the use of plaster-of-Paris dressings, Thomas splints, and simple traction devices can aid materially in reducing the discomfort of these acutely inflamed joints. Poorly padded, loosely applied, and repeatedly removed splints are a source of irritation both to the patient and the attendants. This type of apparatus gives no rest and hence no relief from pain.

The position of fixation in acute joints demands consideration. In each individual joint there is a certain position naturally assumed for complete relaxation. Fortunately these positions approximate both the anatomic position and the positions of optimum function. The individual patient is the best judge of the position of comfort of the individual joint. Their opinion should receive due attention. Fortunately, in these very acute cases, limitation of motion or the fear of future ankylosis may be set aside. Temporarily the positions of optimum function can be sacrificed for the positions of relaxation. In the subacute stages this concession is not permissible, for it is in this stage that fixation or ankylosis of joints occur.

Ankylosis occurs only where there has been intra-articular destruction changes in synovia, cartilage or bone. Limitation of motion may occur from intra-articular adhesions in the synovial pouches or chiefly as fibrosis of the capsule and periarticular structures. The gliding fascial planes are obliterated in the juxta-articular tissues. Mobility in the joint is limited, but there is not ankylosis.

In those patients in whom it is apparent that the intra- or

peri-articular disease may be anticipated to be of long duration, provision should be made for the prevention of deformity and the retention of the position of optimum function in each joint. Apparatus should be supplied and the patient properly instructed as to the reasons for the necessity of its use until the disease process has become entirely quieted. Part time use of the apparatus is more desirable where permissible. Patients if ambulatory or semi-active need the correcting apparatus more at night than when up and about. The essentials of such apparatus must be simplicity of construction, readiness of application or removal, and comfortableness when in effective use.

The optimum position for fixation at the shoulder-joint is at abduction of near 80 degrees upon the scapula with flexion of about 15 degrees anterior to the sagittal plane of the trunk. In ankylosed or partially fixed shoulder-joints this permits ready approximation of the hand to the face, head, and collar-button regions. The compensatory increased scapular mobility adds much to this function. The elbow is best fixed at a 90 degree angle. This is a comfortable and inconspicuous carrying position, also permitting comfortable use of a desk or table, and the face can be reached with the ordinary food transporting tools. At the wrist the hand is best fixed at from 20 to 25 degrees dorsiflexion, this being the position of power in the hand grasp. Where there be involvement of all metacarpal and phalangeal joints, the optimum position is that assumed by the hand in completely grasping a baseball. This overcomes the disastrous disability of the flat hand.

The hip-joints, when ankylosed, function best in abduction of about 15 degrees and slight internal rotation. The knee-joints should be flexed very slightly. The foot should be fixed at from 5 to 10 degrees plantar flexion.

Case I.—Female, aged nineteen, entered the hospital July 10, 1926. In February, 1926 an acute attack of tonsillitis followed by acute polyarticular arthritis, involving the left elbow, left wrist, and the small joints of the left hand. There was slight involvement of both knees, with more severe reaction in the

left ankle and midtarsal joints. The prostration was severe, the temperature varied from 101° to 103° F. for two weeks, gradually subsiding. With the subsidence of temperature the swelling and pain cleared in all joints but the left ankle and midtarsus.

After the afebrile period was established tonsillectomy was done. This was followed by still further improvement in the joint condition. However, the left ankle and tarsus remained persistently painful. The patient was in the hospital about twelve weeks. There was no evidence obtainable to give support to a suspicion of a Neisserian infection.

She states no effort had been made to keep the foot and ankle supported, and that on leaving the hospital her toes were drawn down so that the foot could not be placed on the floor, and walking with crutches was necessary.

The patient was first seen four and one-half months after the onset of her acute illness. She was walking on crutches, bearing no weight on the left lower extremity. Her general condition was good, physical findings were negative except for the left ankle and foot. The foot was in a marked equinus position—at more than 135 degrees, moderately swollen, cyanotic, and cold. The tendo achillis was contracted and fixed; the tibio-astragaloid joint was very stiff, but not absolutely rigid; the sub-astragaloid and midtarsal joints were stiff. The anterior foot was in slight varus, and its joints were slightly movable. Attempted manipulation of the foot did not give rise to much pain.

x-Ray examination showed in the tibio-astragaloid joint the cartilage almost entirely destroyed, and the normal joint space decreased. The subastragaloid and midtarsal joints showed more cartilage destruction with marked bone atrophy surrounding. The tarsometatarsal joints were fair to good.

The patient was advised of the necessity of improving the local circulation in the foot and ankle. There was not enough tenderness to contraindicate weight bearing if this could be accomplished. It was thought also that some correction of the equinus could be obtained by gradually applied force. A plaster

boot was applied, making an extension heel level with the toes. Instructions were given to try weight bearing with the crutches. In two weeks the patient could walk across the room without crutches. She complained only of tingling sensations in the foot. The plaster dressing was wedged three times, so obtaining slight correction. It was removed on the third week. Circulation was distinctly better, there was definitely increased mobility in the anterior foot, but the equinus deformity in the tibio-astragaloid joint had not been changed. A new plaster with high heel was applied and wedged in one week. In this dressing the patient walked fairly well with only a cane.

Operation was advised after five weeks of weight bearing. It was necessary to do a plastic lengthening of the tendo achillis which was repaired after carefully but forcibly breaking up the ankylosis in the tibio-astraglaoid and midtarsal joints. The foot was dressed at 90 degrees upon the leg, recognizing that reankylosis would doubtless occur. On the fourteenth day gradual weight bearing was started. Crutches were entirely discarded at the eighth week; there is a limp due to very slight calcaneus position and fixation in ankle-joint and midfoot. There is slight subastragaloid motion and marked increase in the mobility of the anterior foot. At the end of seven months this patient had learned to walk with a very slight limp, was working full time, and could dance three to four hours with only moderate pain. Improvement in function will continue for some time, but there will always be marked limitation of motion in the ankle and foot. Arthroplasty at the ankle-joint may later be given consideration.

It is probable that limitation of motion could not have been avoided, but the period of disability and the necessity of operative correction could have been prevented. In this case the total disability in the use of the left lower extremity was due to the equinus deformity in the left ankle and foot, so preventing approximation of the sole of the foot to the floor. This drop-foot was acquired in the course of the acute arthritis and in its convalescing stage. This deformity would have been prevented by any measure directed to maintaining the foot at a right

angle on the leg. Blocking up the foot with pillows or a simple right-angled foot-leg splint would have sufficed.

The surgeon familiar with bone and joint pathology enters the picture also in that group of clinically confusing cases requiring a differential diagnosis between acute arthritis and acute hematogenous osteomyelitis in the articular regions. The late diagnosis is simple. The early differential diagnosis is difficult. Much progress has been made in the diagnosis of acute appendicitis. In this condition early surgical treatment is easy and recovery in most cases is rapid. The treatment of appendiceal abscess requires more refined surgical judgment and technic. Complications are frequent and more serious. Recovery is less certain and more prolonged. So early incision and adequate drainage of acute osteomyelitis gives greater possibility than the late operations for the treatment of destructive osteomyelitis with complicating suppurative arthritis.

Case II.—W. S., aged five. Admitted November 25, 1920. The chief complaints were (1) pain and swelling of hips, shoulders, and knees. (2) Contracture of both lower extremities. (3) Fever and general malaise. Four weeks before admission the tonsils were removed in the acute stage of the inflammation. The first night following this the patient had a high temperature with delirium. Fever continued, and one week later pain in right hip followed by local swelling, tenderness, and redness. A few days later similar signs in the left hip, with later involvement of the left shoulder and knee. The temperature has persisted, at times reaching 104° F. The contractures have become progressively worse, especially in the past five days.

Physical Examination.—Shows a boy about five years old, very sick, and in great pain, emaciated, lying on his left side, both knees flexed, and the thighs flexed on the abdomen. Any attempt at motion causes him to cry out with pain.

The throat is reddened, portion of left tonsil remaining. There is a soft cardiac murmur, apparently hemic, the thorax and abdomen show a slight maculopapular eruption.

The joints of the upper extremities are negative. Both

lowers sharply contracted, the right more than the left; region of hip-joints swollen, tense, red, very tender. Any motion prevented by pain.

The temperature was 102° F. The pulse was 130. The respirations were 22.

Laboratory Findings.—On November 26, 1920 the red blood-cell count was 2,900,000; hemoglobin, 55; the white blood-cell count was 15,000; polymorphonuclears, 60 per cent. The Wassermann test was negative. Culture showed staphylococcus.

A diagnosis of acute rheumatic arthritis was made, and the following treatment started: Sodium salicylate, gr. xxx to xl q. d. Sodium bicarbonate, tr. oppi, and codein sulphate for pain; methyl salicylates and heat locally; force food and fluids.

Several days later the general condition showed slight improvement; pain and swelling in right hip persisted, though movements were less painful, and "now the extremities could be almost wholly extended." Temperature ranged from 99° to 104° F., pulse 130 to 150; respirations 20 to 30; white blood-cell count advanced to 17,500 with 75 per cent. polymorphonuclears.

The progress sheet now states that the right hip-joint at this time could hardly be regarded clinically as a suppurative arthritis, but suspicious. *x*-Rays the following day showed acute osteomyelitis of the right femoral head. Immediate incision and drainage was done. Within twenty-four hours temperature dropped below 101° F., and remained so. Drainage was profuse and persisted for about four weeks.

Now after the lapse of another month the patient came under my observation for the purpose of correcting the acquired deformities. The lower extremities showed a severe flexion-adduction, contracture at both hips; a pathologic dislocation on the right, with absorption of the femoral head and a postural dislocation of the left femur with the head in the posterosuperior position. The pelvis was sharply tilted on the lumbar spine; the lumbar lordosis was a part of the thigh flexion contracture.

Corrective treatment was instituted in the way of bilateral traction, gradually increasing the hip abduction as muscular

relaxation took place. Conservative measures at reduction failed on the left hip; the right femoral neck was brought down to the acetabular cavity and held in abduction in plaster. After a period in a walking apparatus to harden the left femur an open reduction was done; the head of the femur later absorbed under pressure.

Eight months after starting the reconstruction work this boy was able to get about under his own power and without support of any kind. Thirty-four months after the onset of his trouble

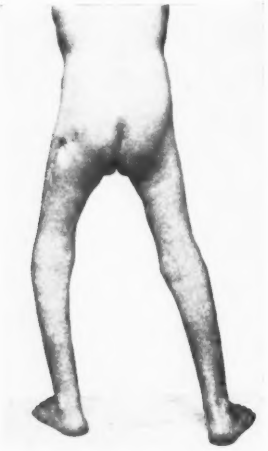

Fig. 92.—Case II. When first beginning to stand at his bedside.

this boy walks twenty blocks to and from school, "besides what he runs around after school. He can walk a crack very well, and can stand in a common doorway and touch each side with his feet. His left hip, however, is still partially stiff, and his limbs don't develop as fast as we think they should." Quotation is the parent's statement. Motion at the hip-joints is about half normal.

In this case one week after admission there was a period when the "extremities could be almost wholly extended." At that time or soon after had traction been applied with protec-

tive splinting, certainly the postural dislocation of the left hip could have been avoided, and the destructive changes in the head of the right femur decreased by earlier recognition of the suppurative arthritis. The pathologic dislocation should be regarded as preventable. The prevention of these combined deformities would have saved the serious and prolonged surgical treatment. The ultimate function would have been better.

The orthopedist in too many hospitals is regarded as the repair man, to be called only after the wreck has occurred. The cardiologist is at a distinct disadvantage when dealing with an adolescent endocarditis secondary to a recurrent tonsillitis. He should be more interested in the prevention of other similar cardiac disabilities. The men on repair duty are usually working harder and with less pleasure than those on construction work. Construction is simpler than reconstruction. In the acute and subacute arthritides prevention of deformity is easier than the later correction of a deformity permitted to have become fixed.

The vast majority of deformities in subacute or chronic arthritis are the deformities of flexion and adduction. The chief cause of these deformities is muscle spasm produced by joint irritation, and the greater strength of the adductor and flexor groups in each segment of the body. For a joint to become fixed in the deformed position considerable time is required. The inflammatory process must have produced much peri-articular scar tissue or enough destruction of cartilage and bone to produce an actual ankylosis. In those cases of deformity and limitation of motion by changes in peri-articular structures the fibrosed and contracted tissues can be stretched gradually by various types of apparatus; or under anesthesia with operative procedures, optimum functional positions of the segments can be restored. These restored positions must be maintained until there is shown to be no tendency of the deformity to recur.

The gradual correction of these fibrosed and contracted structures is by far the safer. This requires much fortitude on the part of the patient with consistent and constant effort on the

part of the attending surgeon. Failure of progress is an early indication for more radical therapy.

Manipulation of stiff joints under anesthesia demands more respect and consideration than is usually accorded the procedure. With pain obscured by the anesthesia, much damage is often done to both soft parts and bone. Secondary to the inflammatory reactions and to disuse there occurs always much bone atrophy. The leverage exertable by passive force on joints is tremendous. Fractures of long bones do occur in the

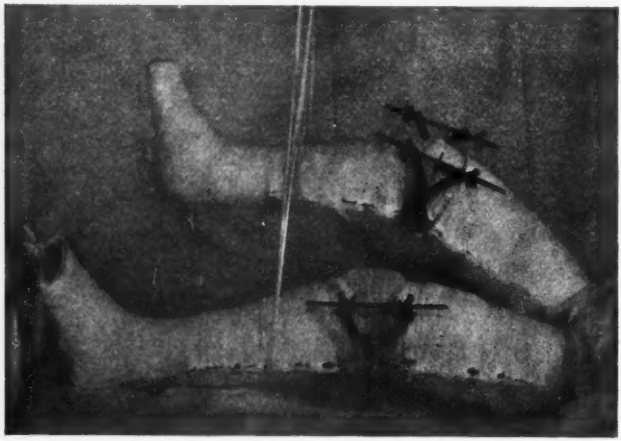

Fig. 93.—Turner splints in plaster-of-Paris segments for gradual correction of knee-flexion deformity.

course of thoughtless manipulations. But the less easily recognized intra-articular fractures produced in these manipulations give rise to far more disaster owing to their greater frequency.

If the purpose of the manipulation be to obtain motion in a stiffened joint it must be known that the joint cartilages are intact. Sufficient gentleness must be used to avoid tearing of the capsule, injury to cartilage, or hemorrhage within the joint. Multiple gentle manipulations are better therapy than single forceful and extensive movements. Motion obtained without

such considerations is usually lost quickly; or if retained, the joint is the painful crepitating type. For most people and most purposes a stiff and painless joint in good functional position is far preferable to a joint movable but painful.

For the correction of flexion deformities there is a multiplicity of devices, each partaking of the mechanical individuality of the designer. The fundamental principles are based on (1) direct traction beginning in the line of the deformity and gradually altered to the corrected position; (2) distraction by means of the screw principle—as in the Spanish windlass on extended levers, the turnbuckle or the rack, and pinion. Where the ad-

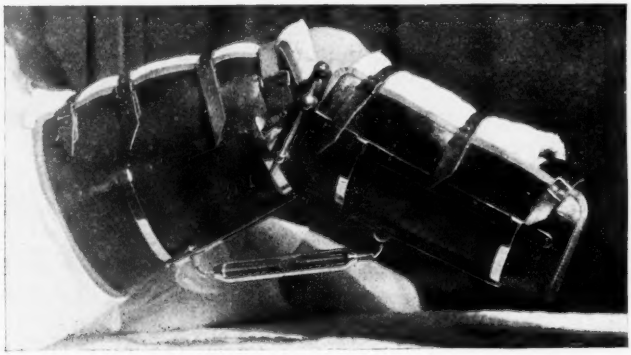

Fig. 94.—Leather turnbuckle knee brace for correction of knee-flexion deformity.

joining segments are long, permitting considerable leverage, distraction is accomplished by the simple wedging of plasters. This is particularly true in early subacute cases where the fixation of the joints is not yet firm.

In the group of spondylitis cases maintenance of proper weight-bearing lines is of major importance. Severe pain in these cases usually follows overactivity or lifting strains. Minor trauma, productive in the normal back of little or no disability, often produce, in these arthritic spines disability of marked degree and prolonged duration. Support of the trunk is indicated early in these cases not only to give symptomatic relief by fixa-

tion, but also to prevent the flexion deformity that is too readily accepted as a necessary end-result. When true bony ankylosis in these spines has occurred, pain disappears and the danger of the crooked back is past. Support by plaster jackets or well-fitting back braces is altogether palliative treatment, but this is very grateful to the patient and adds to his comfort while investigation and elimination of his foci of infection are in progress.

Case III.—Female, aged seventy-two. First seen November 28, 1924, with a chronic infectious arthritis of the hip, non-suppurative, with both destruction and proliferation in bone.

Since middle age she has always had indefinite and generalized "rheumatic" pains. There have been repeated attacks of "sore throat," but not "serious enough to bother about." In early 1923 the patient had an attack of "quinsy." Within a few weeks there was pain and swelling in right hip region with some pain and swelling in finger-joints. After two or three weeks' rest in bed the acute pain gradually subsided, but in the right hip there persisted stiffness, dull and aching pain, made worse on attempted weight bearing. In the past three months any motion is accompanied by "grating and grinding" perceptible not only to the patient, but audible to those in the same room. The hip pains are more pronounced "when the throat is sore."

Examination.—Shows a woman of advanced years, who apparently looks to be sick and in pain. She is able to walk across her bedroom with a cane; before taking a step the right lower is "wiggled" several times to get it "just so." There is a bad right limp, also an audible coarse crepitation.

The right thigh is slightly flexed and adducted, the adductor muscle group is on guard; shortening about $\frac{1}{2}$ inch; active motion is not obtainable in the supine position; passive motion is about one-fourth normal in all directions, but painful and accompanied by coarse palpable crepitation in the hip-joint. All other joints are free and unlimited in motion, no marked arthritic changes.

Dental condition good; the tonsils are very large and badly infected. The cardiovascular changes are not notable.

x-Ray examination (Fig. 95) shows in the right hip obliteration of normal joint contour, cartilage destruction, erosion of the superior portion of acetabulum with new bone formation on the margin. The head of the femur shows destruction of

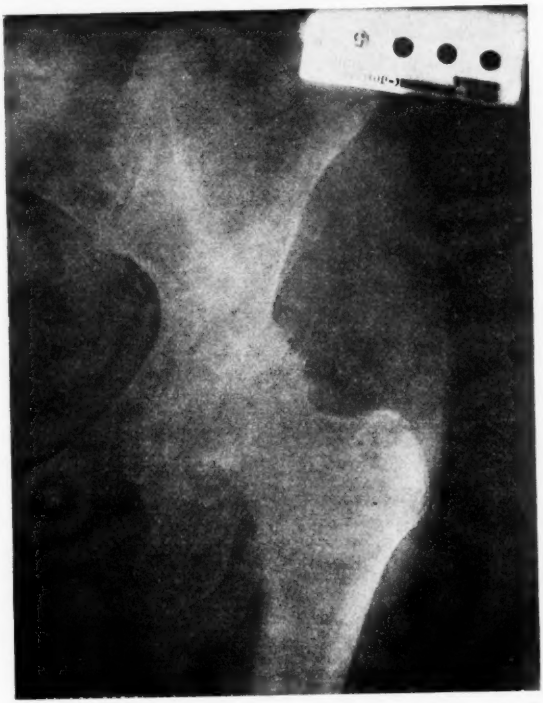

Fig. 95.—Case III. A type of so-called "senile arthropathy."

bone in the superior third, with some flattening of the head and new bone production at the capitocervical junction. In the intertrochanteric region there is an appearance suggestive of an old intertrochanteric fracture united in anatomic position. (There had been no history of recognized trauma.)

Treatment.—The indications were definite. (1) No weight

bearing. (2) Traction for relief of pain. (3) Regular elimination to avoid all possible absorption from a secondarily infected intestinal tract. (4) Tonsillectomy for removal of the most obvious primary source of infection. Carrying out the first three indications and using local antiseptic measures for the tonsils the patient's condition at the end of thirty days was perceptibly improved. Tonsillectomy was then done.

At the end of six weeks traction was used only half time while in bed; crutches were used for three months, beginning to bear weight very gradually. At the end of nine months, using an elevated heel on her shoe, this patient could get about the house freely and with very little discomfort. The crepitation had decreased markedly; range of motion had increased to about one-third normal. Without after-effects she could walk a block at a time, and on one occasion had walked four blocks, but the following day had more than usual discomfort.

This case is a striking example of the so-called senile arthritis. The etiology here is clearly the primary acute tonsillitis with its peritonsillar abscess. The chronic constipation aided in this toxic onslaught. Development of disability was rapid. There occurred here in six to eight months more destruction than usually occurs in as many years.

This type of rheumatic hip usually presents a history of long duration, with symptoms not at all severe, rarely does the pain or limitation of motion become disabling unless aggravated by some minor trauma or sharp decrease in the patient's general resistance. With increasing age and consequent decline in the normal reserve strength the disability becomes progressively more noticeable. It is generally accepted, though not sufficiently proved, that the etiology is a chronic infection secondary to a more remote focal infection. The primary infection usually gives rise to so little local disturbance that its importance is easily overlooked. Many doctors are still to be convinced of the late effects of focal infection. Patients can hardly be expected to be able to grasp the relationship between a throat which is "only sore occasionally" and the far remote joint pain. They are less convinced when they can be told no more than that

each suspected focus must be eliminated and that the result to be accomplished will be no more than the stopping of the progress of the disease. They are hardly content to "stop getting worse." Their desire and demand is to be cured. As a result of this mental state the promise "to cure" gains temporarily a patient for the willing or untrained cultist or the dishonest and uninformed practitioner.

Symptoms will subside in these cases only after eradication of the focal cause and on giving the affected joint the opportunity to rest by decreasing irritation from both motion and weight bearing. After the progress of the disease has been stopped, if disability warrants, reconstruction can be done in the way of plastic operations for increasing range of motion. Length of the extremity can be gained by elevation of the shoe. This lift helps to restore the normal mechanics of the other portions of the body.

CLINIC OF DRS. H. M. McCLANAHAN AND J. A. HENSKE

DEPARTMENT OF PEDIATRICS, UNIVERSITY OF NEBRASKA, COLLEGE OF MEDICINE

I. CASES OF VOMITING IN CHILDREN DUE TO MECHANICAL OBSTRUCTION AT THE PYLORUS.
II. CASES OF VOMITING IN CHILDREN DUE TO TOXEMIA.

I WISH to present two groups of feeding cases in which the predominating symptom is vomiting which is not the result of the type of feeding. The first group of 2 cases represents the type of vomiting due to mechanical obstruction at the pylorus, and the second group of 2 cases, vomiting due to toxemia from focal infection located in the ears and mastoid.

GROUP I

Case I.—C. W., seven months of age.

Family History.—Negative. Only child. No miscarriages. Normal pregnancy. Normal labor and no diseases of the newborn. Birth weight $7\frac{1}{2}$ pounds. Breast fed.

Personal History.—I saw this case at the home when the child was three weeks of age with a history of spitting up and occasionally vomiting with force.

Physical Examination.—Dislcosed an epigastric wave and apparently no loss in weight. The child was placed on a thick gruel feeding prior to nursing. The infant has remained under my observation until the present, and during this time has continued to gain in weight.

At six and a half months of age the baby weighed 17 pounds. This weight represents a little better than a normal gain; in an infant at six months of age the average weight is 15 pounds, 8 ounces. The mother wanted to know whether the child would

continue to need thick gruel feeding, as she found that every time the child was not given the thick gruel feeding the vomiting would recur. The mother was discouraged, although the child was doing very well. She insisted on having the child operated on, as she knew of several cases under our treatment in which children had vomited and had no further trouble after operation. She was advised to place the child in the hospital for operation.

Clinical History.—The particular points are:

1. Has vomited a little practically ever since the second week of life.

2. During the fourth and fifth months of life did not vomit as much.

3. Has been able to keep down only gruels.

4. Always vomited liquids.

Physical Examination.—This was a well-nourished child. The heart and lungs were normal. Abdomen normal, except for the epigastric wave following feeding. The stools were normal.

A Rammstedt operation for congenital hypertrophic stenosis of the pylorus was performed with ether anesthesia by Dr. Alfred Brown.

There was a thickening of the muscular coat of the pylorus and first part of the duodenum, which is about an inch in length, and forms a distinct constriction of the gut at that point.

A small fragment measuring 2 mm. in diameter was removed from this constriction for microscopic examination. Microscopic examination showed it to consist of fibrous tissue. The nuclei were quite small and well differentiated, and they were well separated by interstitial substance. No blood-vessels could be identified in the section. A diagnosis of fibroma was made.

Following the operation the child was given fluids and an ounce of 5 per cent. glucose each hour the first three hours; then the glucose was alternated with an ounce of the formula. Twenty-four hours later the child was placed upon the bottle and given a formula, and within a week the child was on a diet which was regular for its age.

Since then the child has been made an uneventful recovery, the vomiting has ceased, and its condition at the present time is very good.

Case II.—Baby H., seven weeks of age.

Family History.—Negative. Only child. No miscarriages. Normal pregnancy. Normal labor, and no diseases of the newborn. Birth weight 8 pounds, 3 ounces. Present weight 9 pounds, 10 ounces.

Personal History.—The child did very well the first two weeks of life. Then it began spitting up and occasionally vomiting. For the past two weeks the vomiting has become more pronounced and projectile in character. Bowel movements are greenish in color. Urine scanty during the past twenty-four hours. Vomits practically every feeding. The child is breast fed, but loses weight. It had no fever.

Examination.—Physical examination discloses a fairly well-nourished child, showing, however, a marked dehydration. The heart and lungs are normal. A very distinct epigastric wave can be seen. On palpation of the abdomen between the umbilicus and the costal margin a distinct tumor can be felt. An operation was performed with ether anesthesia, revealing a tumor at the pylorus which is unusually long (about $1\frac{1}{4}$ inch) and made up of two masses with a constriction between them. The Rammstedt procedure was chosen, and the abdomen filled with salt solution and closed.

The child was given the usual treatment following the operation and was placed upon the breast thirty-six hours later. These cases usually remain in the hospital five or six days and then are discharged and are kept under observation the first year, the growth and feeding being checked at intervals.

The diagnosis of hypertrophic stenosis of the pylorus is based upon the following clinical signs: Usually the child is normal or above weight at birth. It apparently progresses normally on breast feeding the first few weeks, but usually between the second and fourth week the infant begins vomiting, at first once or twice a day and gradually more often, taking on a more forceful

type, which is called projectile vomiting. I have seen cases of pyloric stenosis with symptoms a few days following birth, and have had 2 cases in which operation was performed within the first ten days after birth, but these are the exception and not the rule. Rapid loss of weight and dehydration depends upon the amount of obstruction. If the abdomen is carefully watched immediately following the intake of fluids there will be noticed waves of the stomach passing from the left costal margin over the epigastrium to the right costal margin. This is more marked in cases in which there is a rapid loss of weight. In case of long standing, as the stomach enlarges, the wall hypertrophies in order to take care of the feedings. There is a certain amount of retention. Oftentimes the infant will retain one or two feedings and then vomit a larger amount than actually given at that one particular feeding. This shows a retention of the food from one feeding to another. This also can be demonstrated by giving the child a test-meal with barium and making a radiographic examination.

We have found that the diagnosis can be made in over 90 per cent. of the cases by clinical signs without the laboratory findings, and the diagnosis proved by operation in all the cases. In a certain percentage of cases a freely movable tumor as large as a hazelnut can be palpated between the umbilicus and right costal arch. In examining for the tumor it is necessary to have warm fingers and to give the infant either a feeding or have it suck on a bottle of water to relax the muscles of the abdomen and keep it from crying. If these cases with the history of yellow stool showing that a certain amount of food is passing through, and with no marked dehydration, are seen early, prior to much loss in weight, or if the child weighs within 25 per cent. of its normal weight for age, gruel feeding or medical measures can be tried. If under these conditions the child retains the food and gains in weight or remains stationary for a few days, and then gains in weight, an operation may not be necessary. Gruel feedings were first recommended by Dr. Sauer, of Evanston, and later by Dr. Langley Porter, of San Francisco. The gruel feeding is made as follows: 10 ounces of boiled skimmed milk; 5 tablespoons-

ful of barley flour, cream of wheat, or rice flour; water 10 ounces, dextrimaltose or milk sugar 2 or 4 tablespoonsful. The flour is mixed with the water, making a paste, then the water is slowly added with stirring to prevent the flour becoming lumpy, and the sugar added to the water and flour. The mixture is heated over an open flame for fifteen minutes, and then the milk is added. The entire mixture is now placed in a double boiler for an hour or longer until it is of such consistency that it will not run off the inverted spoon. It is fed to the infant through a hygiea nipple which is split across the tip, and placed in the child's mouth, the gruel being put into the nipple, from which the child sucks it; another method is to put it upon a tongue depressor and placing this tongue blade on the back of the tongue. With another tongue blade the gruel is shoved off. We have been successful in quite a number of cases which we recognize as partial pyloric obstruction.

We are not justified in following this line of treatment in many of the cases unless the infant can be kept under close observation. We know that the operative treatment is simple and the mortality is practically nil in cases that are seen early. The case seen while still on the breast, whose mother has a sufficient amount of milk, is a good operative risk because following operation the child can be kept on the breast and fed as a normal breast-fed infant.

In order to succeed with gruel feeding it is necessary to have the complete coöperation of the mother. The objections to this treatment in our experience are:

1. Failure to carry out the necessary details.
2. The slow gain.
3. Parents becoming discouraged and abandon treatment.
4. Changing the physician for further experiments.
5. Danger of sudden high fever due to starch indigestion.

We have found the Fredd-Rammstedt operation the simplest and best operative procedure.

Differential Diagnosis.—In congenital atresia of esophagus vomiting or overflow occurs during the feeding and is present from birth. Vomiting in atresia or congenital obstruction be-

yond the pylorus is not of the same character, and the material vomited contains bile. Toxic vomiting shows no signs of an obstructive symptom.

GROUP II

Case III.—Baby O'D., four months of age.

Family History.—Born August 7, 1927 at the University Hospital. Normal delivery. Birth weight 7 pounds. Breast fed until December 7th. Two other children living and well, ages three and a half and five years. Father living and well. Mother living and well. Baby was taken off the breast and placed on Eagle Brand, and the milk was given according to directions on the can. On December 16th baby was taken to the City Mission and was doing fairly well until December 29th, when it began to regurgitate feedings. There was very marked loss in weight, and the baby was sent to the hospital for treatment.

Physical Examination on Admittance.—The eyes seemed glassy and staring. There was a rash in the groins, armpits, and under the chin. Weight 14 pounds, 5½ ounces. Regurgitated feeding. Marked dehydration.

The skin was dry and lacked turgor. Examination of the nose and throat showed a slight redness and slight discharge from posterior nares. Examination of the ears showed a dull membrane with no bulging. The heart and lungs were negative. The abdomen was negative. Temperature on admittance 99° F. The child was apparently very septic and dehydrated. The infant was placed on protein milk which was regurgitated immediately. In spite of gavage and lavage it continued to vomit. Intraperitoneal injections of from 200 to 500 c.c. of normal saline were given twice a day to combat the dehydration.

Laboratory Findings.—The urine was negative. The red blood-cell count was 4,570,000; hemoglobin, 80 per cent.; the white blood-cell count was 9000; polymorphonuclears, 60 per cent.; lymphocytes, 40 per cent.

Paracentesis of the left ear showed a bloody fluid and the right ear some bloody fluid. The child lost 8 ounces the first twenty-four hours. It was in an extremely dangerous condition;

a diagnosis of mastoiditis was made and a double mastoidectomy was performed on December 21st under local anesthesia by Dr. Callfas. The time for opening and draining both mastoids was thirty-five minutes. The mastoid was large enough to admit the little finger and pus was found in both ears. A culture showed a Streptococcus hæmolyticus. The child continued to lose weight and continued to vomit. Various feedings were tried. Intraperitoneal and intravenous injections of glucose were given. Temperature gradually rose until on the third and fourth day it reached 105° F., and persisted between 101° and 105° F. until death occurred on January 11, 1928. The last few days of life the child showed evidence of consolidation at apex of right lung and base of left.

Diagnosis was made of double mastoiditis, severe toxemia, and vomiting due to toxemia which we were unable to control by various methods.

Anatomic diagnosis was bilateral otitis media; bilateral mastoiditis; recent surgical incisions of both mastoid areas; pneumonia with consolidation of the apex of the right lung and base of the left; hyperemia and edema of the brain; cloudy swelling of the liver, spleen, and kidneys; fatty changes of the liver.

Case IV.—Baby S., two months of age.

Family History.—Normal pregnancy. Normal delivery. No neonatorium. Birth weight 9 pounds. Mother and father well. Two other children living and well.

Feeding History.—Breast fed first two weeks. Was taken off the breast by the doctor. Child did not gain, and according to the mother the milk did not agree with the baby, as it cried continuously and had curds in the stools. The baby was placed upon proprietary foods, and did not do well. Various formulas were given, but the child did not gain in weight, and it was admitted to the hospital as a feeding case. The first week the child made a rapid gain in weight and apparently did very well on a modified milk formula. During this first week the child gained 12 ounces. and then within twenty-four hours had lost in weight 4 ounces, and the following morning a loss of 8 ounces.

Child began vomiting. Slight rise in temperature. Frequent bowel movements.

The examination of the ears showed a slight bulging and redness and dull drums in both ears. Paracentesis of both ears was done and a cloudy fluid exuded through the openings. Within twelve hours the child ceased vomiting and temperature returned to normal. Infant is gradually gaining in weight again. In the past week since the paracentesis, the child has gained 8 ounces, the vomiting has ceased, and the stools have returned to normal.

These 2 cases present certain types in infection in infants that are often overlooked, for without a thorough examination many times the feeding is blamed and the actual cause is overlooked. If there is a sudden loss in weight and dehydration or bowel disturbance in a feeding case that has been apparently doing well, and the food has been agreeing, do not make a change in the food until a thorough examination discloses that there is no disturbance elsewhere. I think we are apt to place the blame on the food without thoroughly searching for other causes of vomiting and disturbances. This subject has been very thoroughly discussed in the last few years. Six years ago Jeans reported on focal infection and bowel trouble in infants. Three years ago Dr. Marriott's article on middle-ear and intestinal disturbances was published. Others are Dr. Floyd's article, "Anhydremia Mastoiditis Simulating Alimentary Intoxication," and Dr. Marriott's later article on "Remote Results of Certain Focal Infections Occurring During Infancy and Childhood." Many other articles have been written in the past three or four years on this subject. We have known for a number of years that upper respiratory infections and infections of paranasal sinuses, otitis media, and mastoiditis, cause a severe toxic disturbance and disturbance in the metabolism. The symptoms referable to the alimentary tract happen to be more marked, and this fact directs our attention more to the alimentary tract than to the real cause of the condition. Otitis media occurs in the summer months as well as in the winter, and a careful feeding history will determine whether or not the feeding *per se* is the cause of the vomiting, or whether the intestinal disturbance is due to a parenteral

infection. If there is a sudden disturbance when the child has been on a feeding that apparently has agreed with it, it has been gaining in weight, and all the details of the feeding have been carried out, one should look—particularly in this age when milk is boiled and there is very little danger of contamination of the milk—for infection in some other part of the body as a cause for the toxic condition. As a rule there are no local evidences of mastoiditis, and many cases apparently show very little disturbance of the middle ear, but practically always a dull drum membrane is found. If found it should be opened in order to determine whether there is any fluid behind it or not, for many of these drum membranes do not bulge, but after perforating, in some cases pus will be found exuding through the opening and in other cases merely a bloody fluid. As a rule there is some slight discharge or a history of a discharge from the nares, and the mother usually makes the statement that the child had a slight cold a few days prior to the symptoms. It is not a very easy matter to examine the ear drum of an infant, and it is necessary to have a very small speculum of the infant's size and a very good light, as on a number of occasions I have had otologists examine the ears of infants and report them normal, but have found out that by experience and with the proper direct illumination and by examining all infants that one soon learns to differentiate the abnormal from the normal.